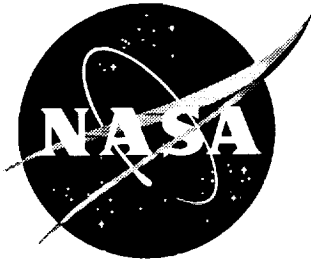


NASA/CR-2001-210649



Response of the Alliance 1 Proof-of-Concept Airplane Under Gust Loads

*A. S. Naser, A. S. Pototzky, and C. V. Spain
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March 2001

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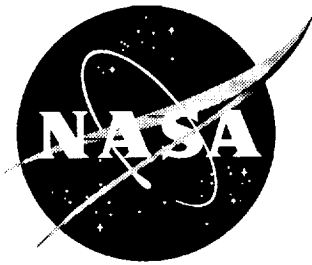
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Prepared for Langley Research Center
under Contract NAS1-96014

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ABSTRACT

This report presents work performed in support of NASA's Environmental Research Aircraft and Sensor Technology (ERAST) program. The primary purpose of this work was to develop and demonstrate a gust analysis method that accounts for the span-wise variation of gust velocity on unmanned aircraft characterized by high aspect ratios, low wing loading, high flexibility, and low airspeeds. The main focus of the work was therefore to perform a two-dimensional Power Spectrum Density (PSD) analysis of the Alliance 1 Proof-of-Concept Unmanned Aircraft. Suitable structural and aeroelastic Finite Element Models (FEM) were developed. One- and two-dimensional PSD gust analyses of the Alliance 1 were performed. For further validation and comparison, a two-dimensional PSD gust analysis was performed on a simple example problem, and a one-dimensional discrete gust analysis was performed on the Alliance 1. This report describes this process, shows the relevant comparisons between analytical methods, and discusses the physical meanings of the results.

INTRODUCTION

This report presents the work performed by Lockheed Martin's Langley Program Office in support of NASA's Environmental Research Aircraft and Sensor Technology (ERAST) program. The primary purpose of this work was to develop and demonstrate a gust analysis method that accounts for the span-wise variation of gust velocity. The evaluation of span-wise variation of gust velocity is important for these unmanned ERAST aircraft because they are characterized by high aspect ratios and low wing loading, are very flexible, and fly at low airspeeds. In the past, the gust response of these aircraft has been mainly investigated using the Pratt-Walker formula¹ that is derived from a discrete gust approach. However, the Pratt-Walker formula does not capture the effects of structural flexibility and the span-wise variation of gust velocity. The main focus of the work was therefore to perform a two-dimensional Power Spectrum Density (PSD) analysis of the Alliance 1 Proof-of-Concept Unmanned Aircraft. As of this writing, none of the aircraft described in this report have been constructed. They are concepts represented by analytical models.

The process first involved the development of suitable structural and aeroelastic Finite Element Models (FEM). This was followed by development of a one-dimensional PSD gust analysis, and then the two-dimensional PSD analysis of the Alliance 1. For further validation and comparison, two additional analyses were performed. A two-dimensional PSD gust analysis was performed on a simple MSC/NASTRAN² example problem. This served as a basis for comparison because an independent two-dimensional analysis had previously been performed on this analytical model. Finally, a one-dimensional discrete gust analysis was performed on the Alliance 1. This report describes this process, shows the relevant comparisons between analytical methods, and discusses the physical meanings of the results and comparisons.

1 FINITE ELEMENT MODELS OF THE ALLIANCE 1 PROOF-OF-CONCEPT UNMANNED AIRCRAFT STRUCTURE

1.1 Introduction

The Alliance 1 structural FEM used in this work was derived from a semi-span FEM originally developed by Scaled Composites Inc³. The Scaled Composites' FEM contained chord-wise grids on the lifting surfaces that were joined to the elastic axis grids by very stiff beam elements. By replacing the stiff beams with MSC/NASTRAN⁴ rigid elements, the number of degrees-of-freedom was substantially reduced. In addition, the chord-wise incidence angle of the wing was eliminated as it was not needed for the linear aeroelastic model. Consequently, the plane of wing grid points has dihedral angle but no angle of incidence. On the horizontal and vertical tails, additional grids were introduced at 80% chord along the full span of these surfaces to represent the hinge lines of the control surfaces. The new semi-span model was compared to the Scaled Composites' FEM by checking the mass properties, natural frequencies, and mode shapes, which all matched. Later, in the gust analyses, the mass was changed to represent a desired fuel condition.

Figure 1.1 shows the resulting MSC/NASTRAN semi-span model which was used in the one-dimensional PSD gust analysis. A corresponding full-span model possessing identical stiffness and mass properties was used in the two-dimensional PSD gust analysis. The FEM input files are included in the appendices and are referred to as appropriate throughout the report.

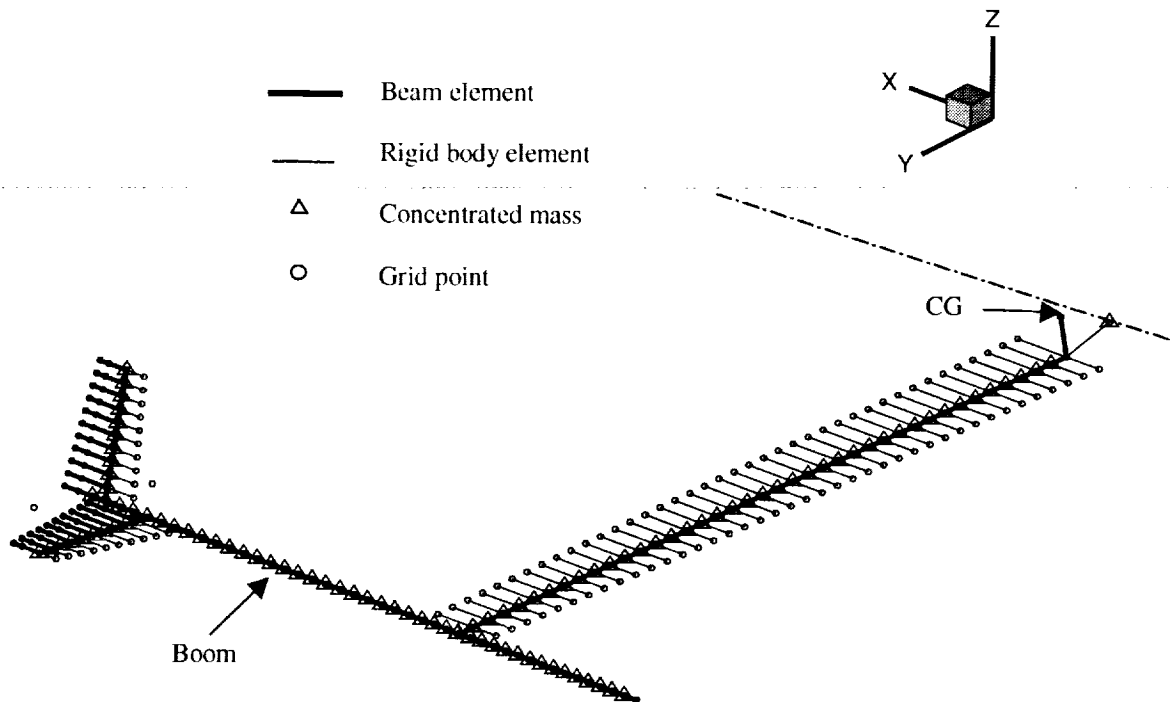


Figure 1.1: Semi-span structural FEM of the Alliance 1 Aircraft showing beam elements, rigid body elements, grid points and concentrated masses.

The stiffness properties are contained in beam elements (heavy lines in Figure 1.1) which run along the elastic axis of the wings, booms, horizontal tails and vertical tails. Very stiff beam elements also connect

the tail elastic axes with grid points at 80% chord and at the trailing edges. All of the model mass is contained in the concentrated masses which are offset from the grids that lie along the elastic axes. Rigid body elements connect the grid points at the leading and trailing edges of the wing, and leading edges of the tails. The purpose of the grids connected to the main structure by the rigid body elements is to provide mode shape displacements so that motion can be splined onto the aerodynamic surfaces.

In order to aid the model verification process, a number of grid points were added to the horizontal and vertical tails. On each tail surface, coincident grids were positioned on the existing grid locations at the leading edge, elastic axis, and trailing edge. However, the displacements of these extra grids are presented in the local tail coordinate systems.

1.2 Aeroelastic Models

As with the structural model, the aeroelastic model started with a semi-span model originally provided by Scaled Composites Inc. In the present work, both semi-span and full-span aeroelastic models were developed, with the full-span containing a left half which is symmetric to the right half, but identical in terms of properties. Following are descriptions of the coordinate systems and aerodynamic paneling for the semi-span aeroelastic model.

1.2.1 Coordinate Systems:

Coordinate systems used for structural modeling and aerodynamic paneling include:

- a) Basic coordinate system (coordinate system 0) which is used to define locations of all structural grid points. The origin for this coordinate system is on the fuselage centerline ahead of the airplane with the x-axis directed aft and the y-axis out the right side. The basic coordinate system also serves as a Cartesian aerodynamic coordinate system. Aerodynamic flow is in the positive x direction and the x axis of every aerodynamic element is parallel to the flow.
- b) Reference axis system for stability derivatives (coordinate system 12) has its origin at grid 101 on the airplane centerline with x-axis directed forward and z-axis downward.
- c) Local coordinate systems which place their (x, y) axes in the plane of the horizontal and vertical tail surfaces (coordinate system 5 for horizontal tail and 6 for the vertical tail).
- d) Coordinate systems whose y-axes define the hinge lines of the aerodynamic panels that constitute the control surfaces on the vertical and horizontal tails.
- e) Element coordinate systems for aerodynamic macro elements (CAERO1 entry of Reference 1) which govern the sequence numbering of the doublet lattice aerodynamic boxes. There are a total of 6 coordinate systems of this type, with two on the right-side wing (origins at grids 101 and 118), two on the non-movable sections of the horizontal and vertical tails (with origins at grids 1301 and 1411 respectively), and two on the control surfaces of the horizontal and vertical tails (grids 2501 and 2611 respectively).

1.3 Aerodynamic Paneling

Figure 1.2 shows the structural grids and aerodynamic panels used in the semi-span model. The main wing was divided into inboard and outboard panels, with the break occurring at a span station of 223.5

inches. The horizontal and vertical tails each are modeled with two panel elements. In both cases, the first panel extends from the leading edge of the lifting surface up to the hinge line, and the second panel continues from the hinge line to the surface trailing edge.

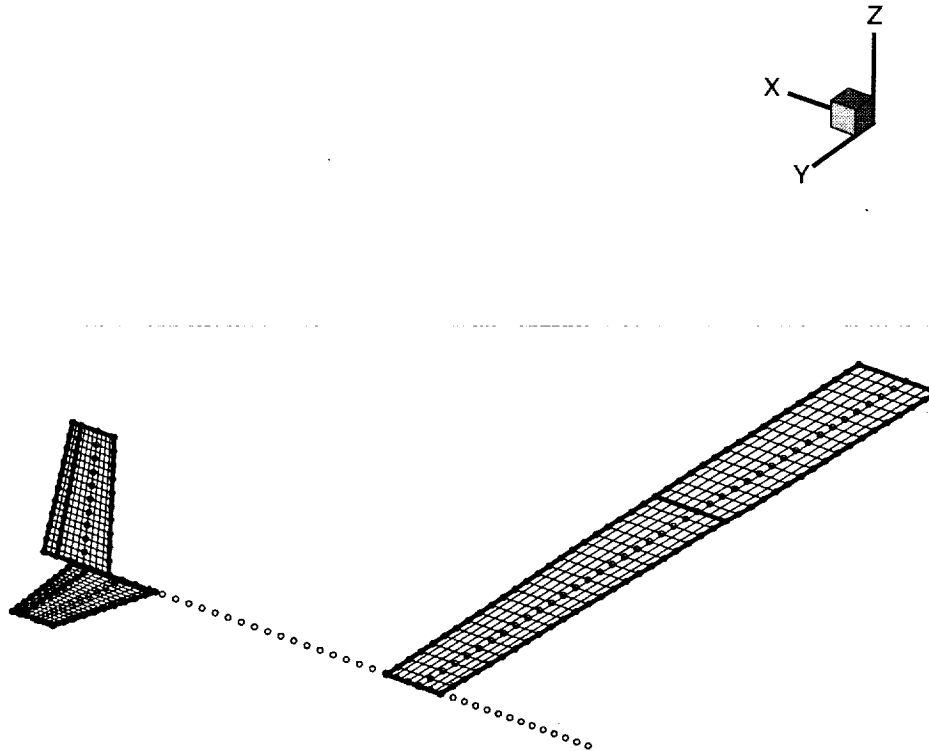


Figure 1.2: Semi-span aeroelastic FEM showing structural grids and aerodynamic panels and boxes.

Figure 1.3 gives an overview of the full-span aerodynamic model, and Figure 1.4 shows the aerodynamic box number pattern. The inboard wing panels have 8 chord-wise boxes and 17 span-wise boxes, while the outboard wing panels have 8 chord-wise boxes and 23 span-wise boxes. The panel box identification labels begin with 10001 for the right inboard wing and 20001 for the right outboard wing and so on. For the right side horizontal tail, the first panel begins at the leading edge and has 8 chord-wise boxes up to the hinge line of the control surface at 80% chord. The box labels begin with label 30001. The control surface aerodynamic panel has 2 chord-wise boxes and begins with label 31001. Both horizontal tail aerodynamic panels have 20 span-wise boxes. On the right side vertical tail box 40001 begins at the tip leading edge and extends to the 80% chord hinge line. This panel has 8 chord-wise boxes and 20 span-wise boxes. The panel extending from the hinge line to the trailing edge has 2 chord-wise boxes, 20 span-wise boxes and begins with label 41001. The left side aerodynamic panels and boxes have a similar numbering scheme as shown in the figure.

The modal displacements of aerodynamic boxes are related to displacements of the structural grids by a surface splining technique. Doublet Lattice aerodynamic modeling does not allow for angle of incidence, camber or twist in lifting surface panel definition. Therefore, the present model does not include such geometry. While these effects are disregarded in lifting surface flutter methods, they could, in the real world, affect aeroelastic trim and gust loading.

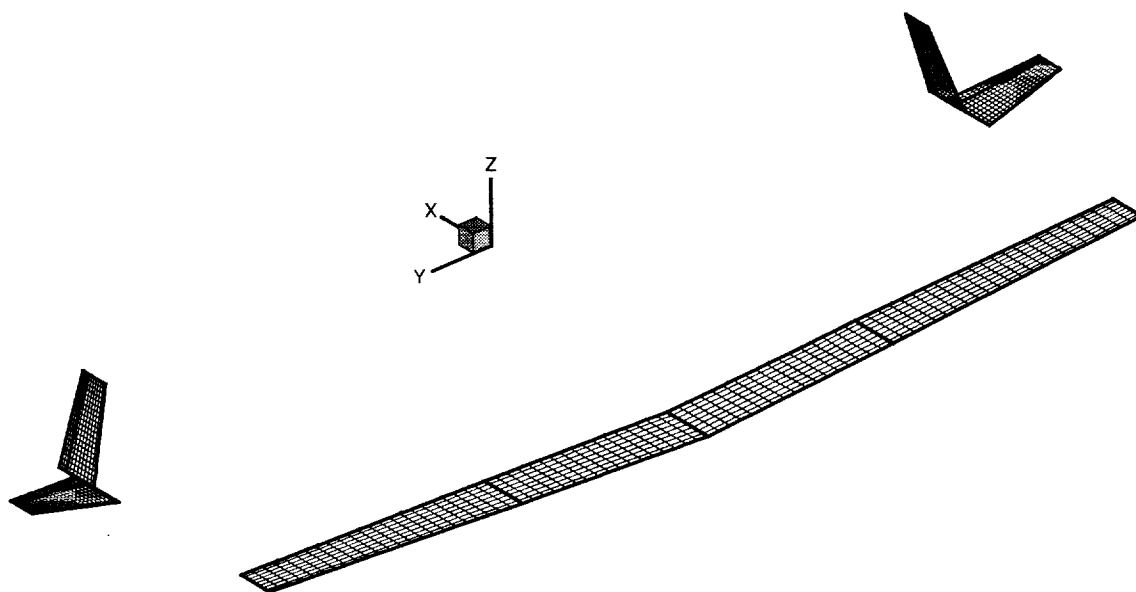


Figure 1.3: Overview of full-span aerodynamic model.

1.4 Verification of Semi-Span Aeroelastic Model

In order to demonstrate that the model was well conditioned and that it would be free from flutter at conditions of interest for gust analysis, trim and flutter analyses were conducted as described further below. Appendix A contains the input FEM file for trim, and Appendix B for flutter. Table 1-1 gives the weight, center of gravity (CG) location, and first 10 symmetric modal frequencies for the semi-span model used in the verification process. Symmetric modal frequencies (for the semi-span model) were produced by applying symmetric boundary conditions at the wing root.

A flutter solution was obtained using the PK method. The input conditions were at Mach 0.0, sea-level, velocity variation from 176 in./sec. to 7040 in./sec., and use of the 10 lowest-frequency symmetric modes. Inspection of the aerodynamic panel displacements in the rigid body pitch mode confirmed proper surface spline interpolation from the structural to the aerodynamic grid points. The model is flutter free for the configuration and conditions analyzed. The MSC/NASTRAN output file containing detailed modal data and flutter results can be produced by the input file in Appendix B. The differential pressure coefficient for the right wing and right horizontal tail at trim conditions are shown in figures 1.5 and 1.6, respectively.

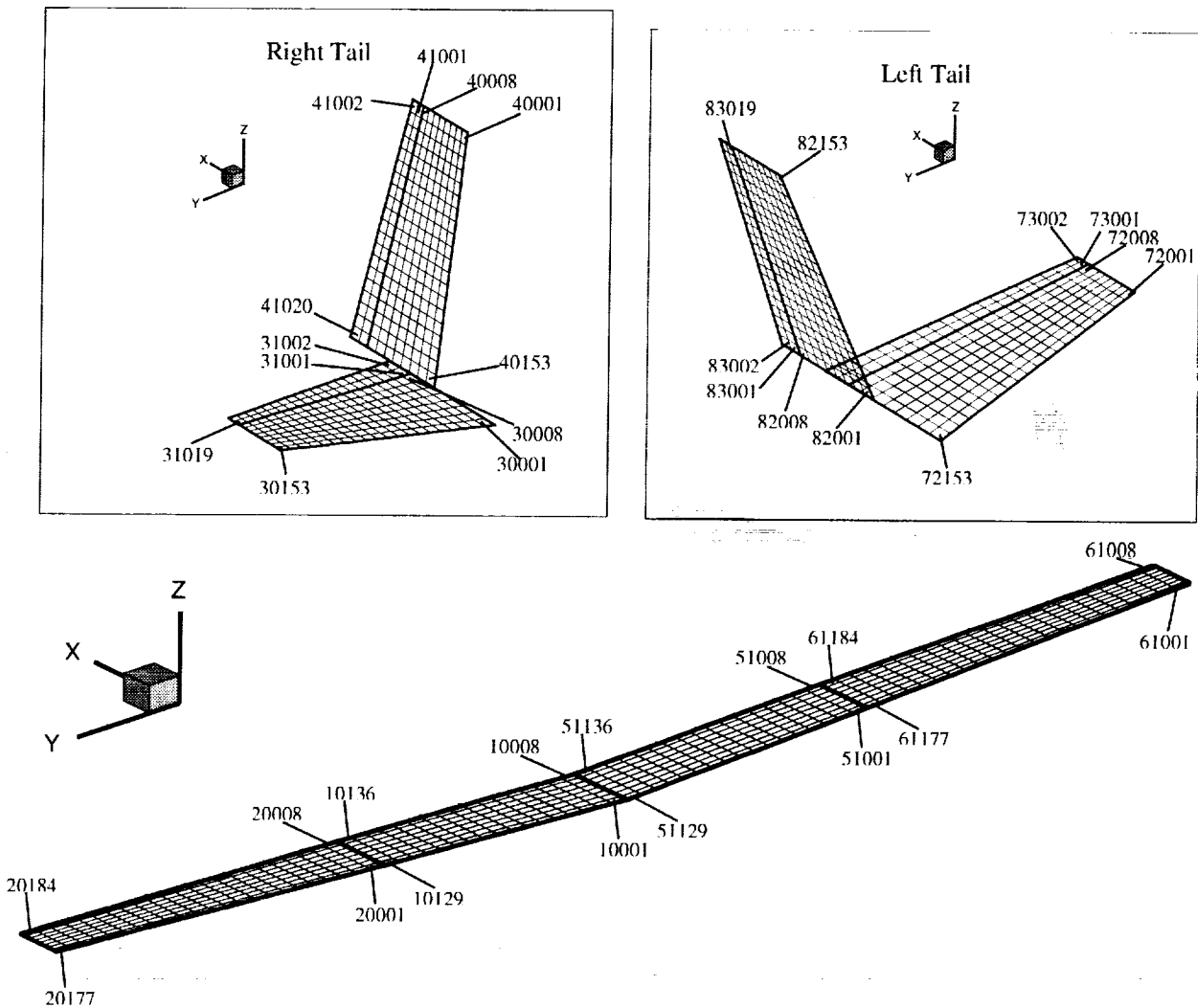


Figure 1.4: Full-span aerodynamic FEM showing aerodynamic panels and box number pattern.

Table 1-1: Summary of weight, CG and frequencies for verification model.

Weight	X-CG	Y-CG	Z-CG
1255 lb.	160.366 in.	219.461 in.	74.855 in
Frequencies (Hertz)			
0.38			
0.81			
1.19			
1.77			
2.18			
3.94			
5.29			

Note: CG is with respect to the origin of basic coordinate system. Inertias are with respect to CG.

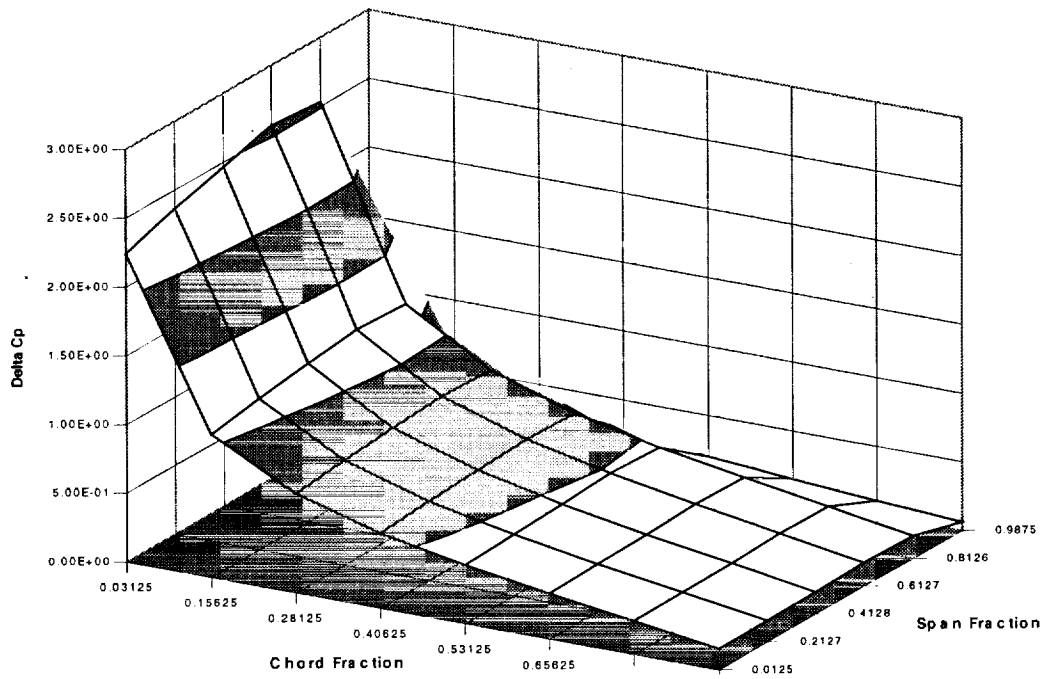


Figure 1.5: Differential pressure coefficients for the right wing at trim condition.

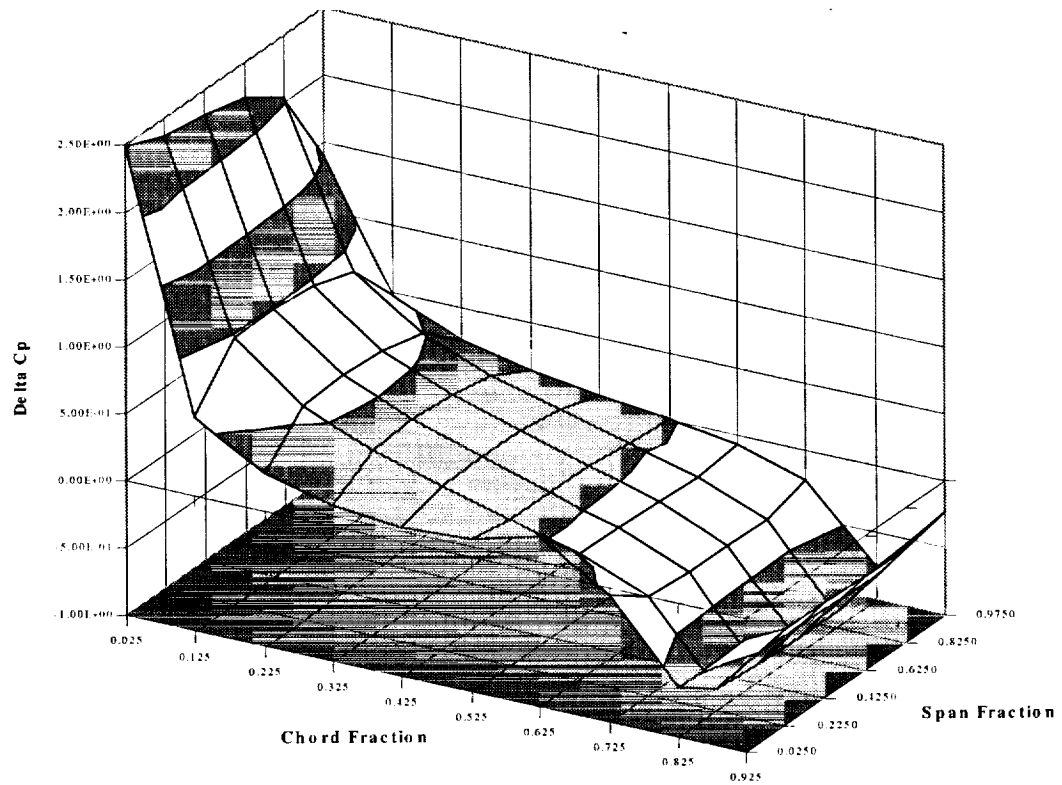


Figure 1.6: Differential pressure coefficients for the right horizontal tail at trim condition.

2 ONE-DIMENSIONAL VON KARMAN PSD GUST ANALYSIS

The purpose of this phase of the work was to perform dynamic analysis of the semi-span Alliance 1 aircraft subjected to a one-dimensional random gust load. The power spectral density (PSD) of the gust load is represented by the von Karman model⁵. The finite element program MSC/NASTRAN⁴ was used for the entire analysis. The input data requirements were generated for a single set of flight conditions. Symmetry conditions were imposed on grid points located on the plane of symmetry and 32 normal modes spanning a frequency band up to 60 Hertz were included in the analysis. PSD of different response quantities such as accelerations, moments and torques at critical grid points of the structures are generated and plotted for a range of frequencies that covers the elastic modes of vibration. The semi-span finite element model is shown in Figure 2.1 with some of the critical grid points labeled for identification. Appendix C contains the complete MSC/NASTRAN data deck.

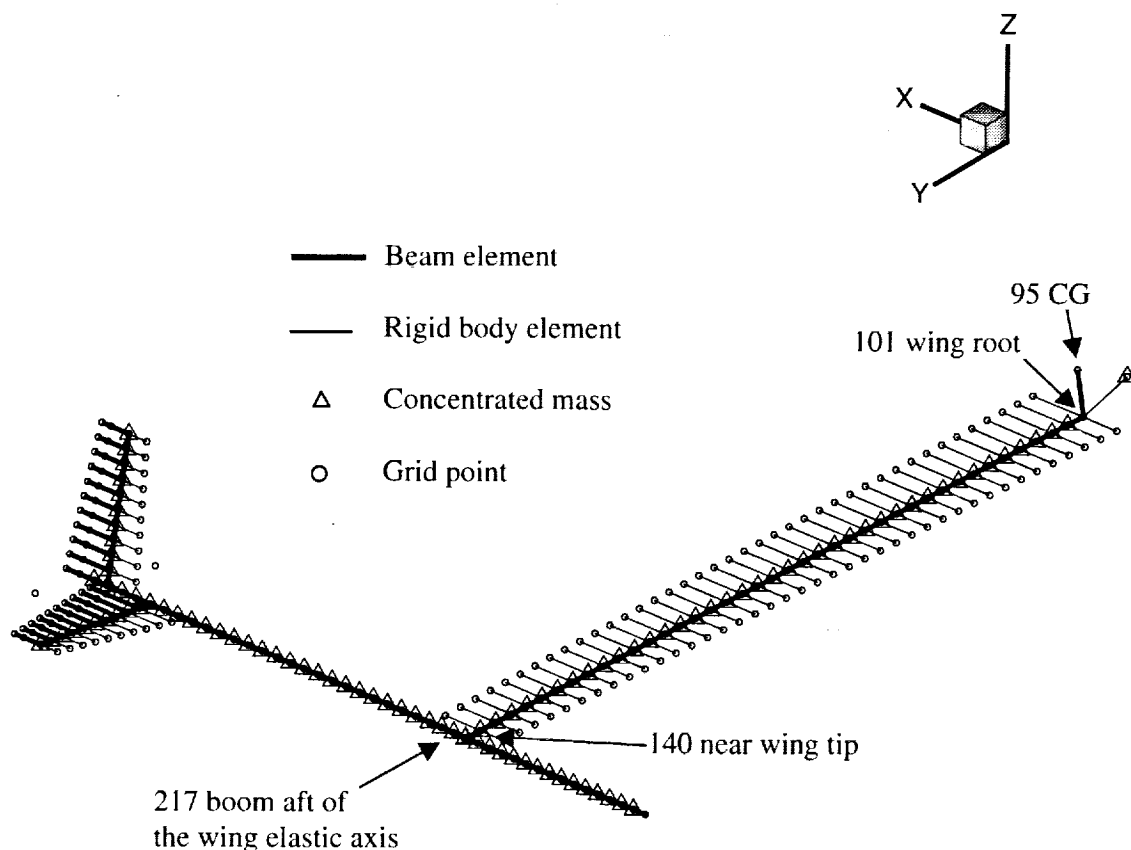


Figure 2.1: Semi-span structural FEM of the Alliance 1 Aircraft showing critical grid points.

2.1 Flight Conditions

The MSC NASTRAN Finite-Element model of the aeroelastic semi-span Alliance 1 Proof of Concept aircraft model was described in Section 1. Data records required to support a random dynamic loads analysis using the von Karman gust spectrum⁵ were inserted into the MSC/NASTRAN Bulk Data deck. Analyses were conducted at the following flight conditions:

Altitude:	1000.0 ft
True Air Speed:	98.3 ft/sec
Dynamic pressure:	0.077444 psi
Mach Number:	0.09
Fuel Loading Condition:	333.9 lb. (total full model fuel weight)

2.2 Response Quantities Investigated

The PSD of the loads and accelerations at different grid points of interest were investigated. Loads were calculated at grid points 101(wing root), 140 (on the wing elastic axis near the tail boom), and 217 (on the tail boom just aft the wing elastic axis). The loads investigated are:

- Plane 1 bending moment, M1, which is the moment about the element's vertical axis (wing or boom in-plane bending moment).
- Plane 2 bending moment, M2, which is the moment about the element's horizontal axis (vertical bending moment).
- Plane 1 shear force, V1, which is the web shear force in the direction of the element's horizontal axis (in-plane shear).
- Plane 2 shear force, V2, which is the web shear force in the direction of element's vertical axis (vertical shear).
- Total web torque T.

The PSDs of accelerations were calculated at grid points 95 (the center of gravity of the corresponding full airplane), 140, and 217. The accelerations investigated are:

- Transnational acceleration in the global x-direction, A1, which is in the direction of the flow.
- Transnational acceleration in the global z-direction, A2, which is in the vertical direction.
- Rotational acceleration about the span-wise axis, A5, which is the pitching acceleration.

2.3 MSC/NASTRAN Input and Output

The desired total fuel weight was entered into the data deck distributed among 7 grid points. A normal modes analysis (Solution 103) was performed to obtain the new weight and center-of-gravity (CG) location and to determine the number of modes within a frequency band of 60 Hertz for symmetric boundary conditions on the vehicle centerline. The imposed boundary conditions permit vehicle fore-and-aft motion, vertical translation, and pitch rotation for the plane-of-symmetry grids. Since one of the desired output quantities is the acceleration at the center of gravity of the airplane (CG), an additional grid point was added to the model at the new CG position. This grid was given the identification label of 95 and connected to Grid 101 on the vehicle centerline with a relatively stiff beam element (see Figure 2.1).

The von Karman PSD of the gust is defined on the TABRNDG Bulk data deck input record. User input requirements were:

L (Scale of turbulence): 1000.0 ft
 WG (Root-mean-square gust velocity): 1.0 in/sec

Additional input cards required to support the analysis were:

DAREA	Defines scale factors for dynamic loads set
FREQI	Defines frequencies used in solution of frequency response problems
GUST	Defines a stationary vertical gust
RANDPS	Defines load set PSD factors
RLOADI	Defines form of the frequency-dependent dynamic load
TABLEDI	Defines frequency band for generation of dynamic loads
PARAM	inputs required included:
LMODE	Specifies the number of lowest normal mode to include
MACH	MACH number used to compute aerodynamic matrices
Q	Specifies the dynamic pressure

To obtain a listing of the von Karman spectrum an extra point was defined using the EPOINT Bulk Data entry in conjunction with DMIG. This procedure, which is described in the MSC/NASTRAN Aeroelastic User's Guide⁴, positions an extra point into an unused region of the stiffness matrix which provides a way to calculate the spectrum of the input gust. The PSD of the von Karman gust is shown in Figure 2.2. This plot is generated from EPOINT 9990. It is worth mentioning that while the equation in the MSC/NASTRAN Aeroelastic User's Guide² for the von Karman equation is incorrect, the actual analysis in the code is correct.

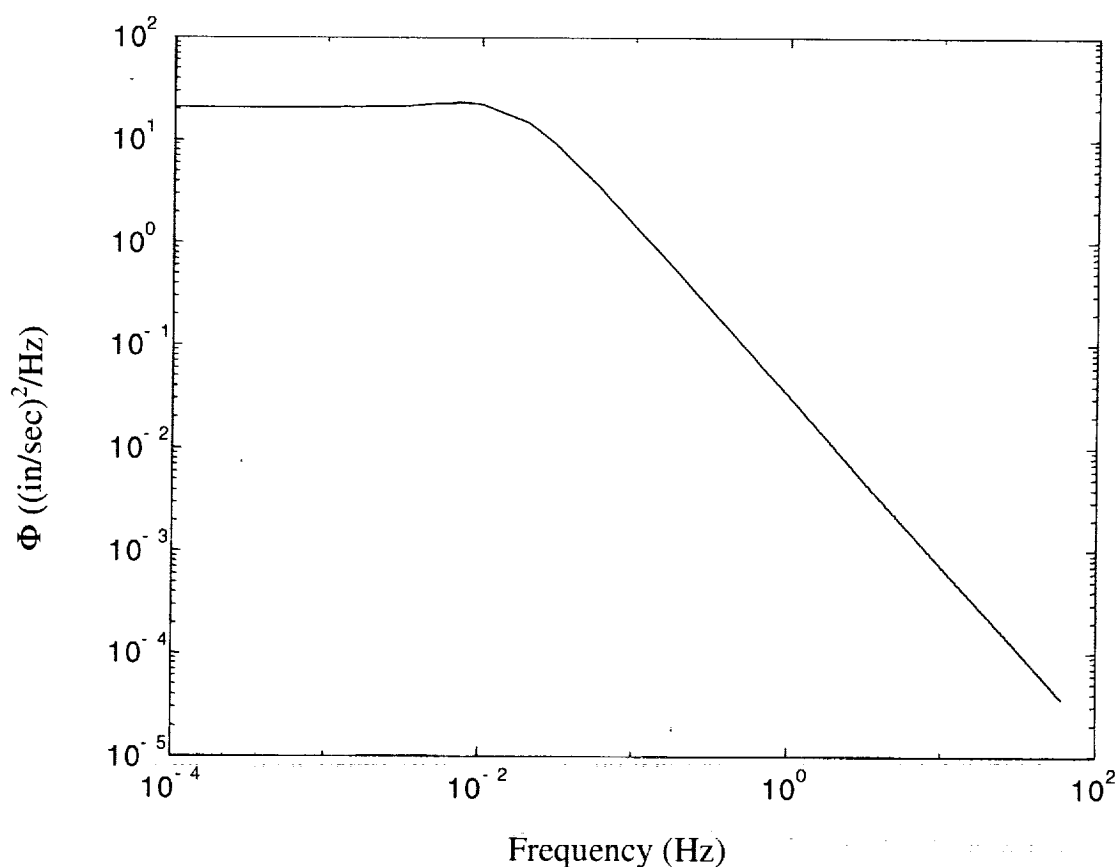


Figure 2.2: Power spectral density function of the von Karman gust.

2.4 Results and Discussion of the One-Dimensional Analysis

A summary of the weight and the location of the CG of the semi-span model with respect to the basic coordinate system is given in Table 2-1.

Table 2-2 shows the lowest 32 natural frequencies of the structure for a for symmetric boundary conditions on the vehicle plane of symmetry. The first 3 modes are rigid body modes (plunge, pitch, and fore-aft.). The elastic mode shapes are plotted in Figure 2.3.

Table 2-1: Weight summaries for the half-span model with respect to the basic coordinate system.

Weight (lb)	X-C.G. (in)	Y-C.G. (in)	Z-C.G. (in)
1047.7	160.9	207.2	77.1

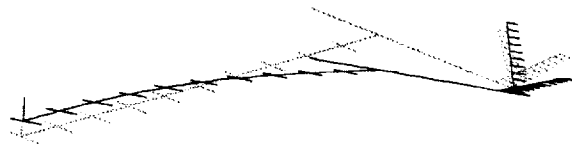
Table 2-2: Natural frequencies of the modes included in the one-dimensional PSD gust analysis.

Mode #	Frequency (Hz)	Mode #	Frequency (Hz)	Mode #	Frequency (Hz)	Mode #	Frequency (Hz)
1	0.000	9	4.117	17	15.340	25	38.740
2	0.000	10	6.115	18	16.717	26	40.058
3	0.000	11	6.749	19	21.315	27	43.874
4	0.380	12	8.314	20	23.917	28	44.948
5	0.813	13	9.271	21	26.451	29	50.464
6	1.290	14	10.870	22	31.500	30	51.756
7	2.036	15	12.840	23	31.927	31	55.838
8	2.201	16	14.599	24	36.936	32	59.570

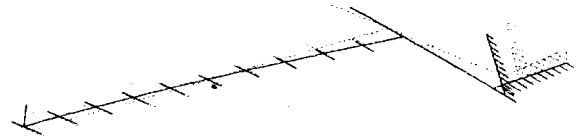
The excitation frequencies used in the frequency response solution ranged from 0.001 Hz to 60.0 Hz in three bands specified on FREQ1 data records. Figure 2.2 shows the Power Spectral Density of the von Karman gust over this total frequency band.

PSD of the bending moment in the vertical plane, M_1 , for grid point 101 is plotted in Figure 2.4. PSD of M_2 , V_1 , V_2 , and T for the same grid point are shown in Figure 2.5-Figure 2.8, respectively. The largest response for bending moment, M_2 , occurs at a frequency of about 0.4 Hz, which is the frequency of the first bending mode. A smaller peak of M_2 response occurs at a frequency of 2 Hz. It can be seen from figure 6 that this frequency is the natural frequency of the second bending mode of the wing. Higher modes do not appear to influence the bending moment response. Moment M_1 has a large and sharp peak at about 2 Hz with multiple smaller peaks at lower frequencies. The PSD of the torque at this point has peaks at 0.8 Hz and 1.3 Hz, which are the natural frequencies of the first two torsional modes of the wing.

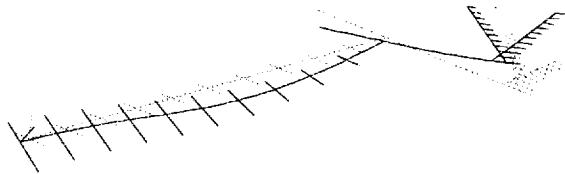
Results similar to Figure 2.5-Figure 2.8 are shown in Figure 2.9-Figure 2.13 for grid point 140. Results are also shown in Figure 2.14-Figure 2.18 for grid point 217. The peaks of the different loads for each of the points studied vary depending on the location and type of quantity studied.



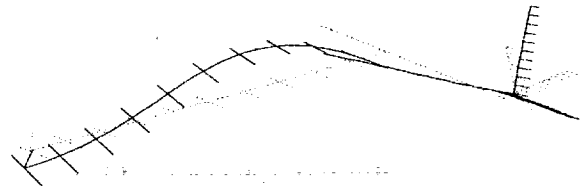
Mode shape no. 4 at 0.380 Hz



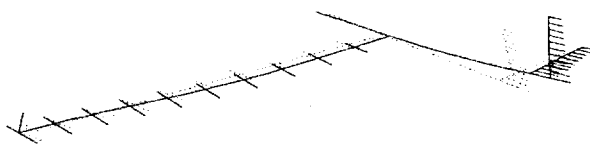
Mode shape no. 5 at 0.813 Hz



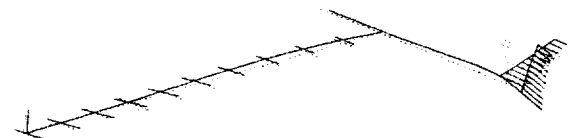
Mode shape no. 6 at 1.290 Hz



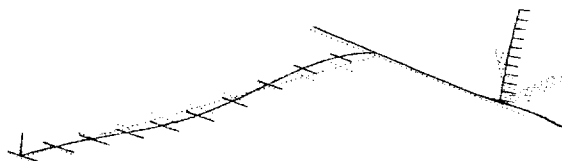
Mode shape no. 7 at 2.036 Hz



Mode shape no. 8 at 2.201 Hz



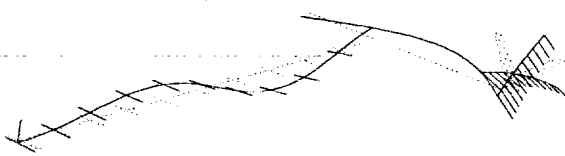
Mode shape no. 9 at 4.117 Hz



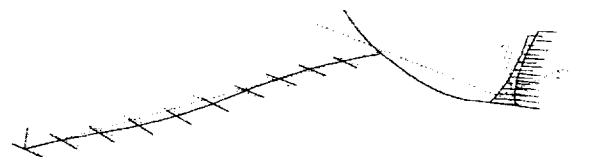
Mode shape no. 10 at 6.115 Hz



Mode shape no. 11 at 6.749 Hz

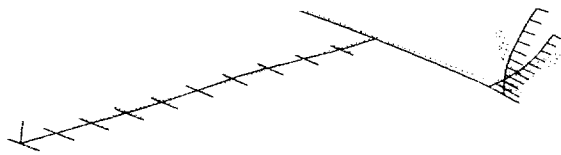


Mode shape no. 12 at 8.314 Hz

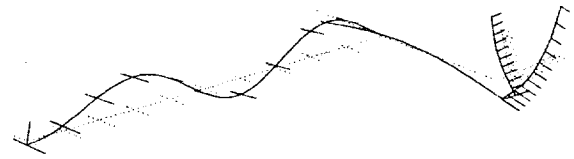


Mode shape no. 13 at 9.271 Hz

Figure 2.3: Flexible mode shapes for one-dimensional gust analysis.



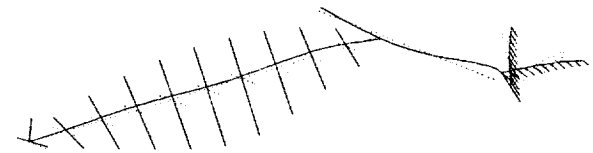
Mode shape no. 14 at 10.870 Hz



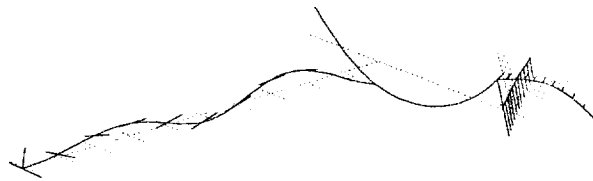
Mode shape no. 15 at 12.840 Hz



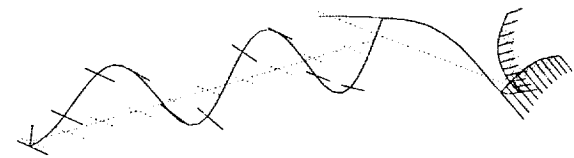
Mode shape no. 16 at 14.599 Hz



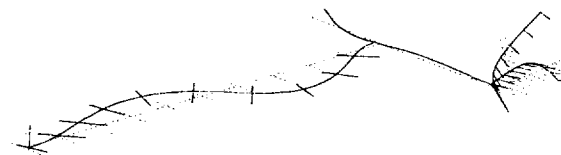
Mode shape no. 17 at 15.340 Hz



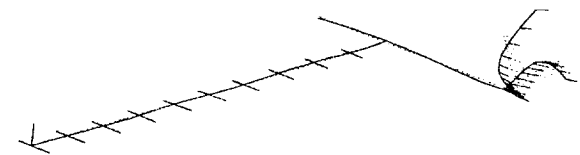
Mode shape no. 18 at 16.717 Hz



Mode shape no. 19 at 21.315 Hz



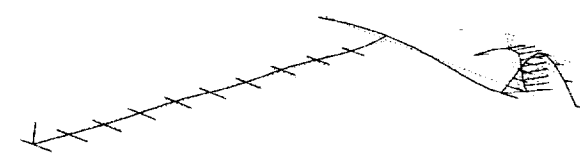
Mode shape no. 20 at 23.917 Hz



Mode shape no. 21 at 26.451 Hz

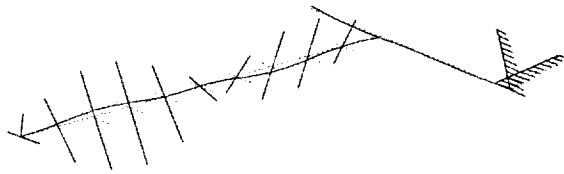


Mode shape no. 22 at 31.500 Hz

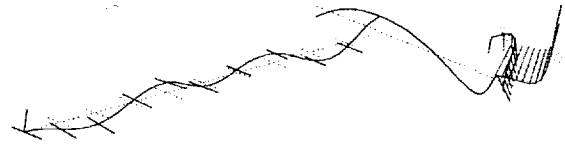


Mode shape no. 23 at 31.927 Hz

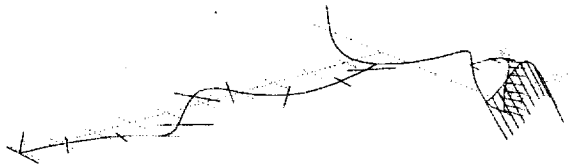
Figure 2.3: Flexible mode shapes for one-dimensional gust analysis (continued).



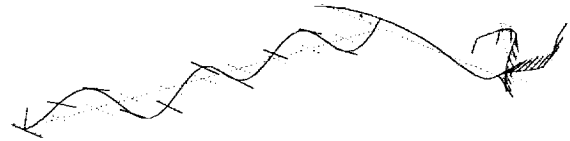
Mode shape no. 24 at 36.936 Hz



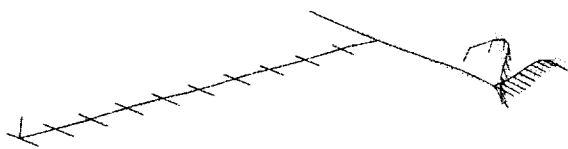
Mode shape no. 25 at 38.740 Hz



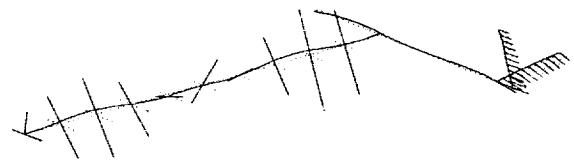
Mode shape no. 26 at 40.058 Hz



Mode shape no. 27 at 43.874 Hz



Mode shape no. 28 at 44.948 Hz



Mode shape no. 29 at 50.464 Hz



Mode shape no. 30 at 51.756 Hz



Mode shape no. 31 at 55.838 Hz

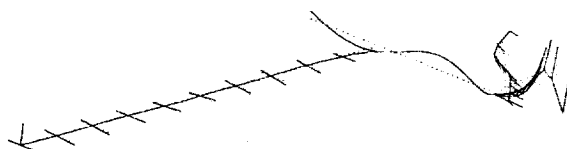


Figure 31: Mode shape no. 32 at 59.570 Hz

Figure 2.3: Flexible mode shapes for one-dimensional gust analysis (concluded).

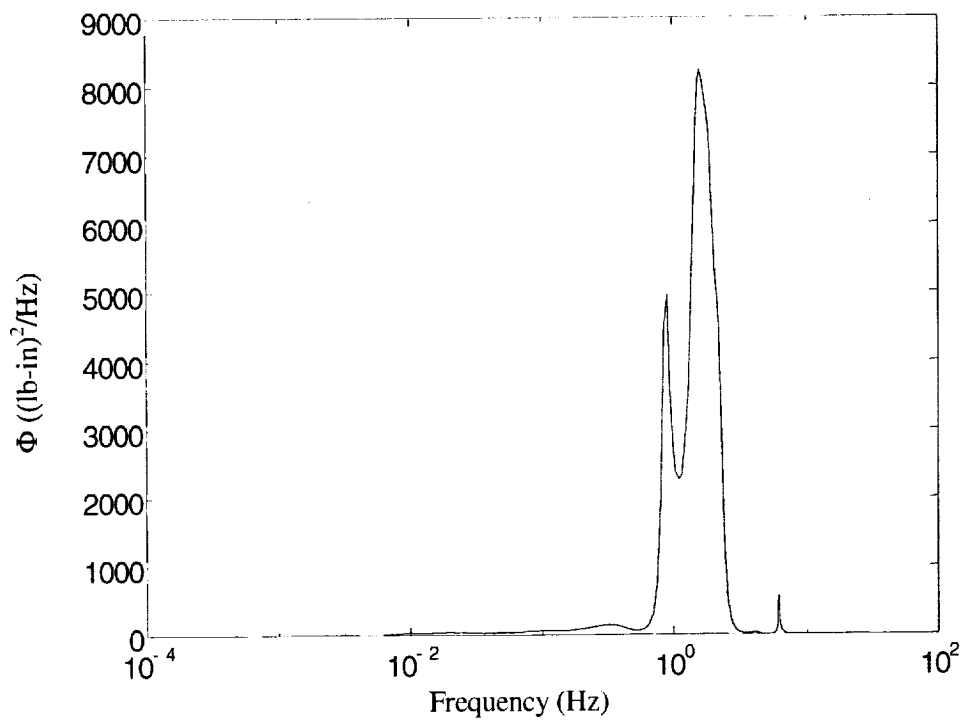


Figure 2.4: Power spectral density of M_1 at grid point 101.

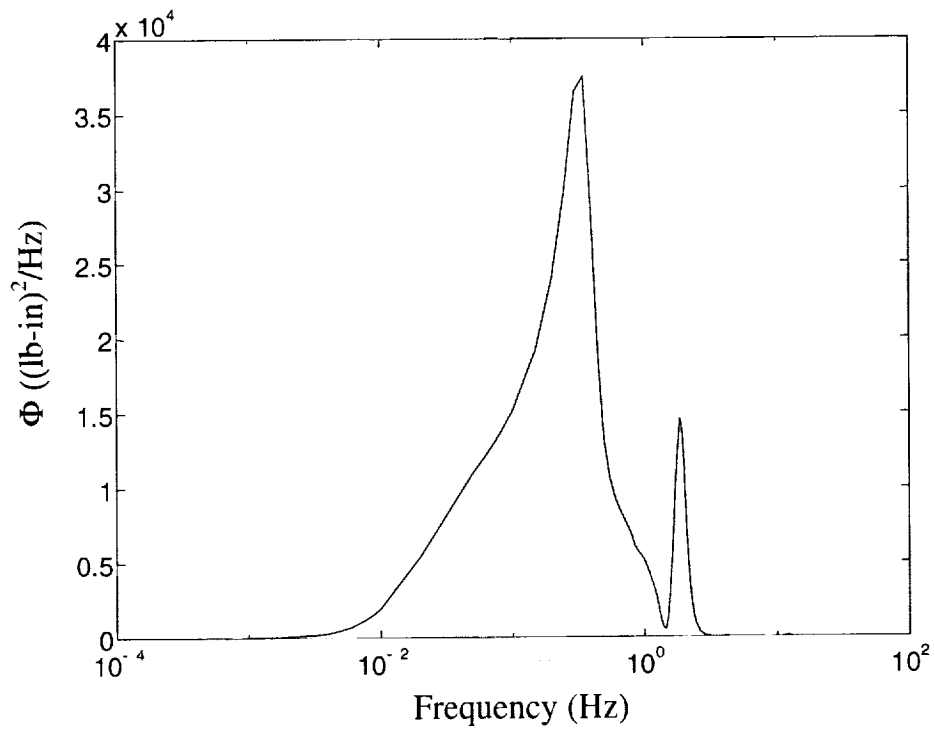


Figure 2.5: Power spectral density of M_2 at grid point 101.

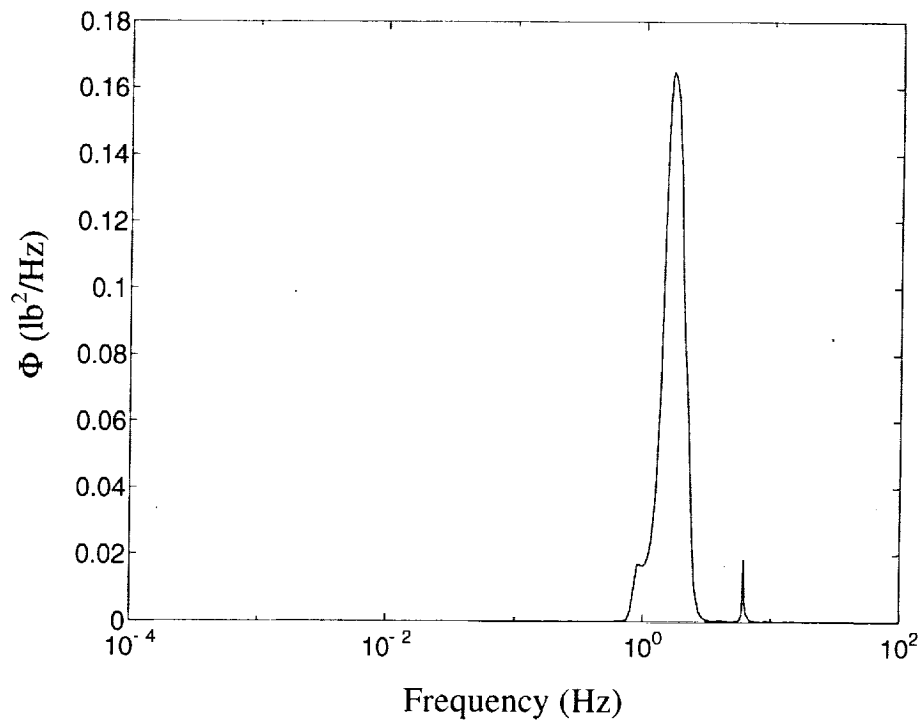


Figure 2.6: Power spectral density of V_1 at grid point 101.

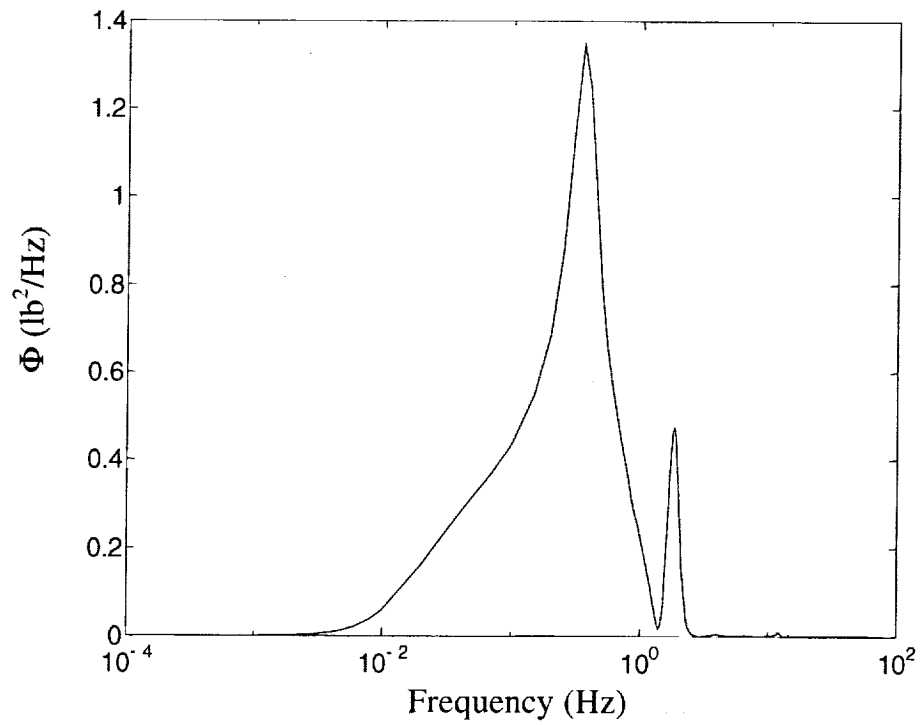


Figure 2.7: Power spectral density of V_2 at grid point 101.

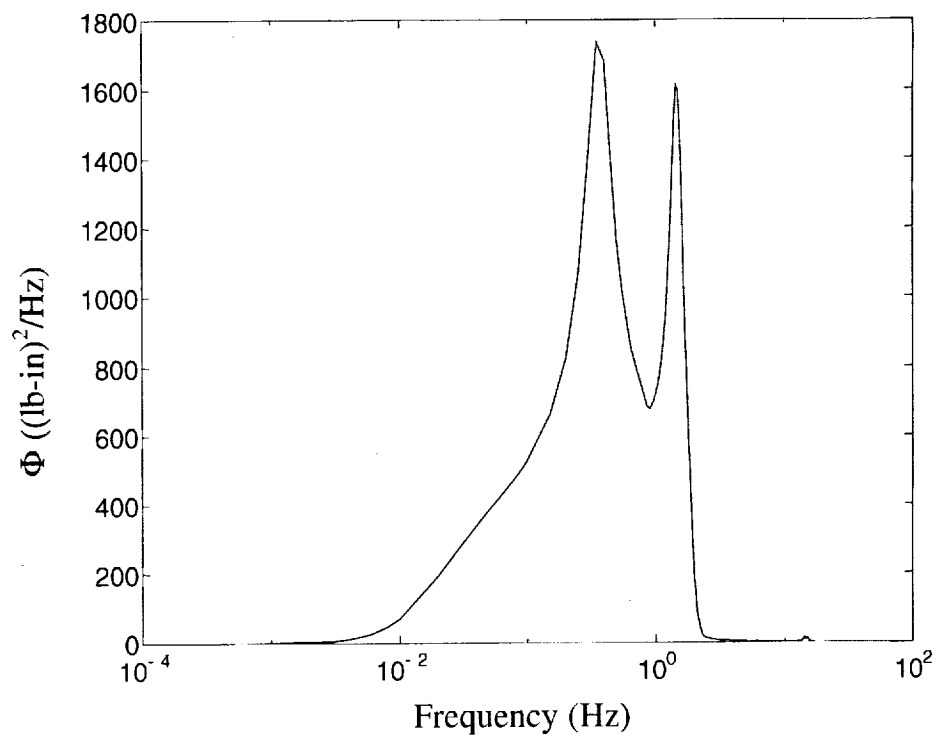


Figure 2.8: Power spectral density of T at grid point 101

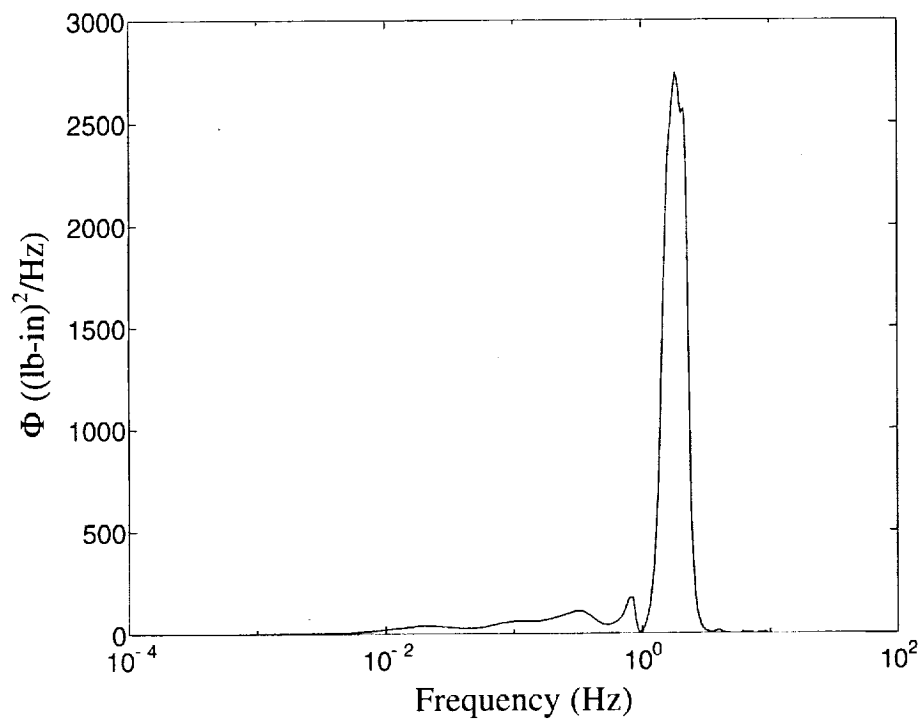


Figure 2.9: Power spectral density of M_1 at grid point 140.

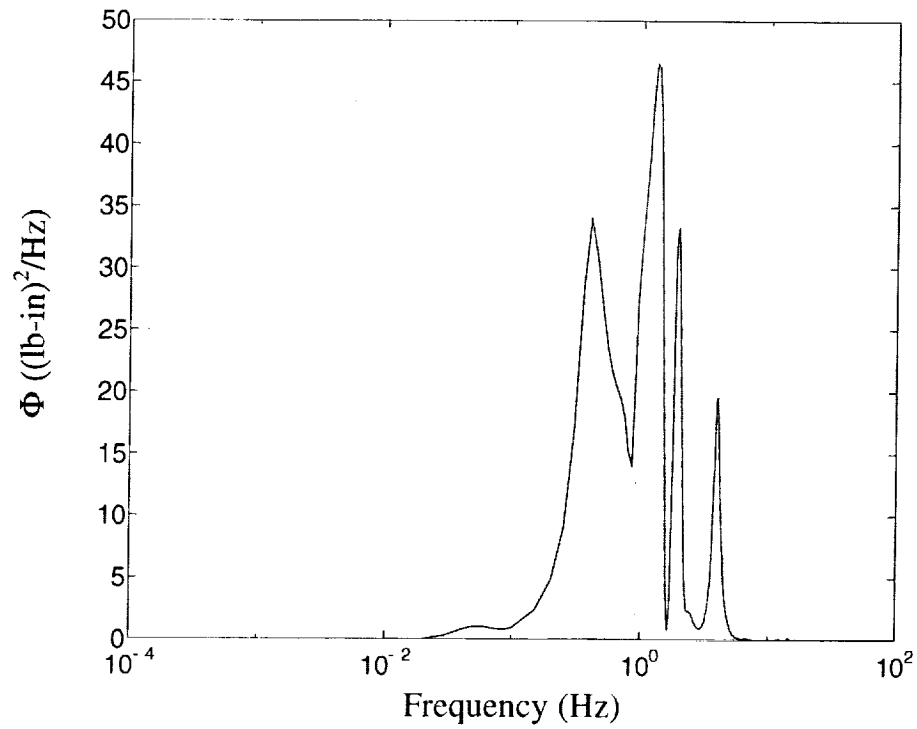


Figure 2.10: Power spectral density of M_2 at grid point 140.

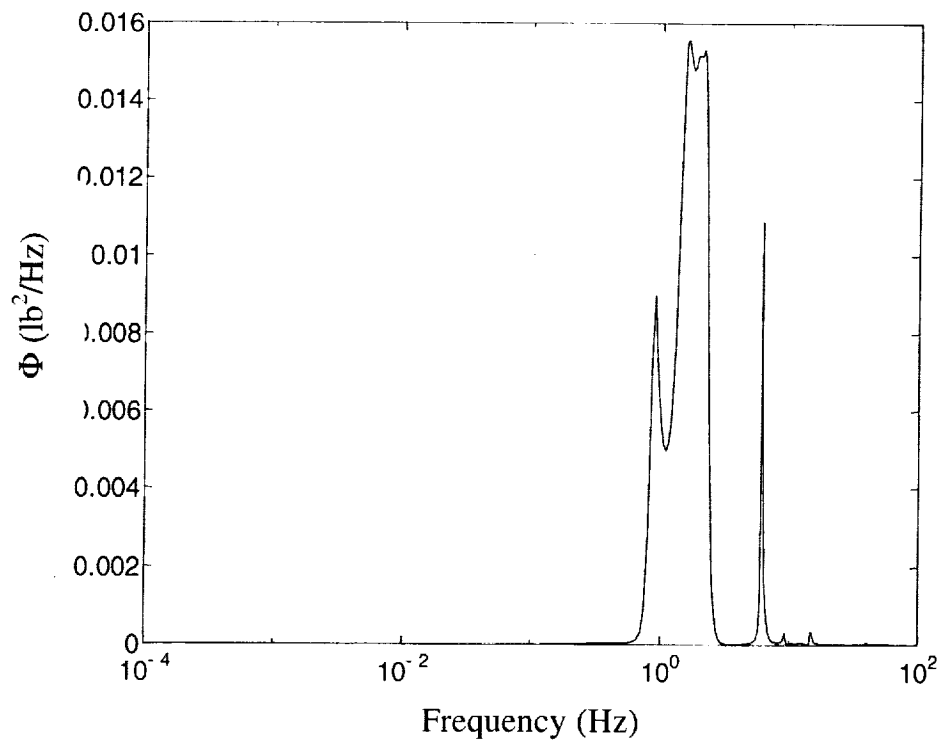


Figure 2.11: Power spectral density of V_1 at grid point 140.

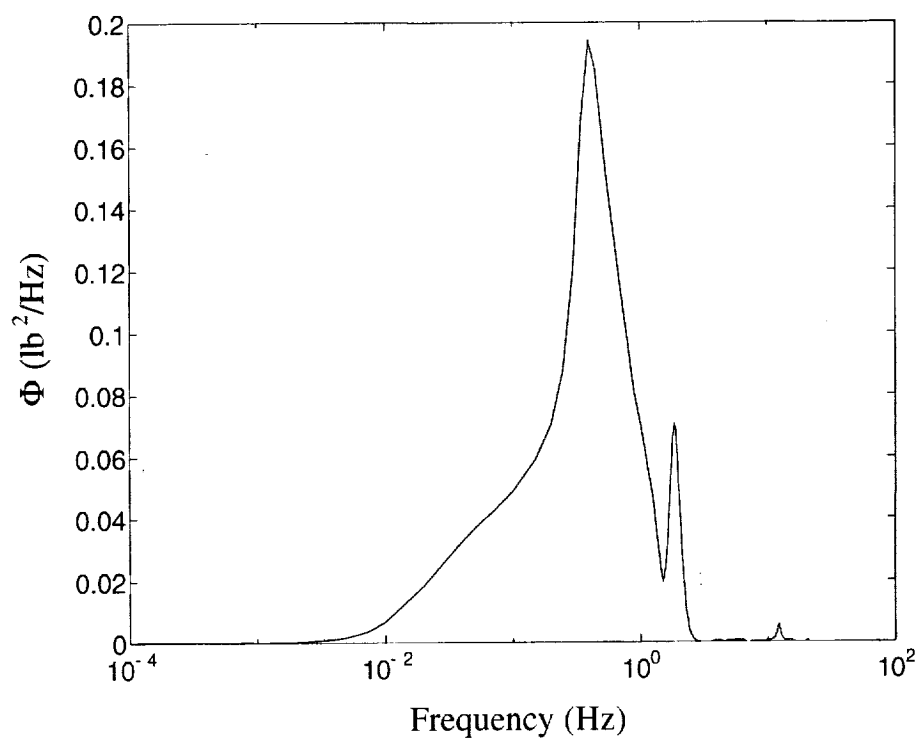


Figure 2.12: Power spectral density of V_2 at grid point 140.

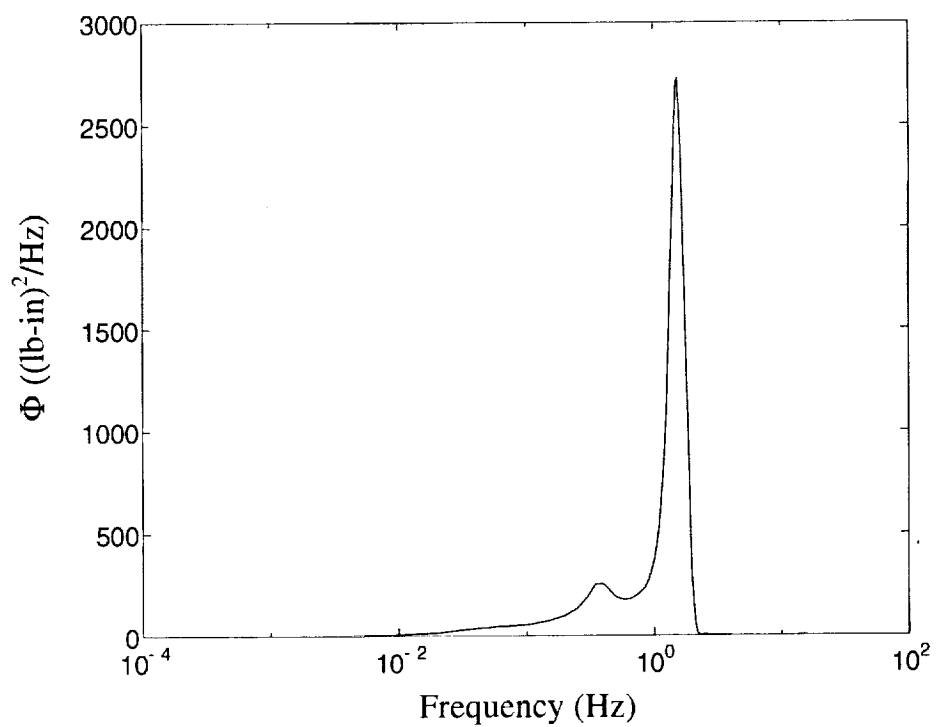


Figure 2.13: Power spectral density of T at grid point 140.

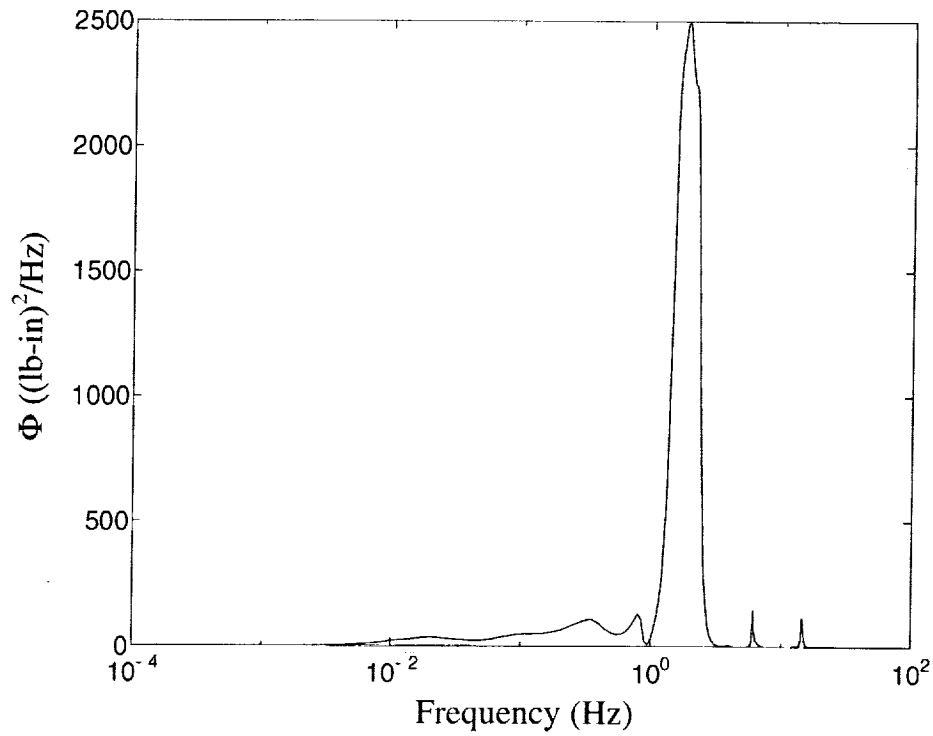


Figure 2.14: Power spectral density of M_1 at grid point 217.

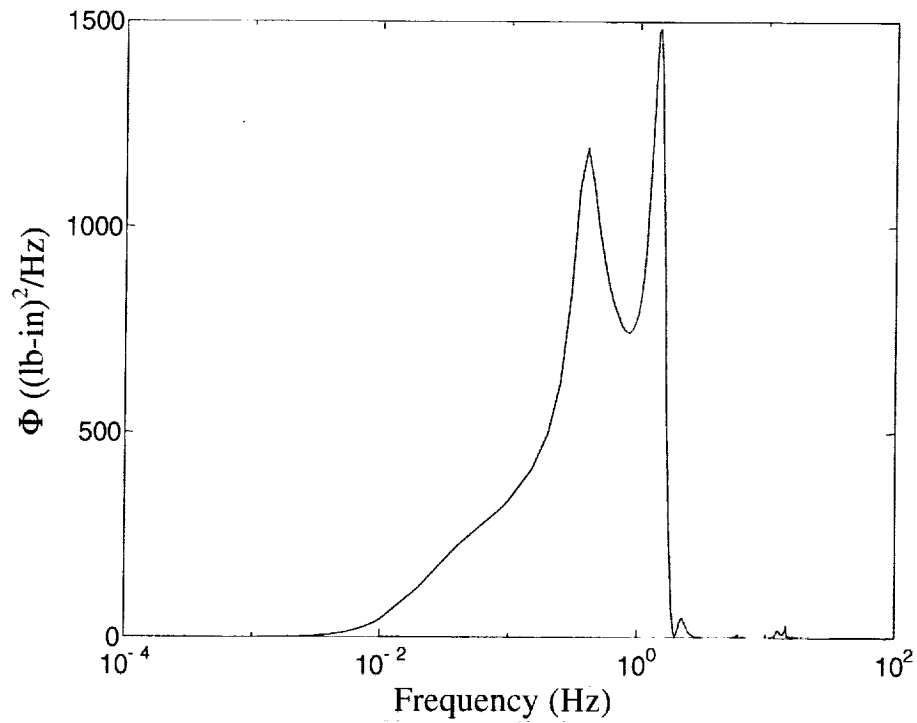


Figure 2.15: Power spectral density of M_2 at grid point 217.

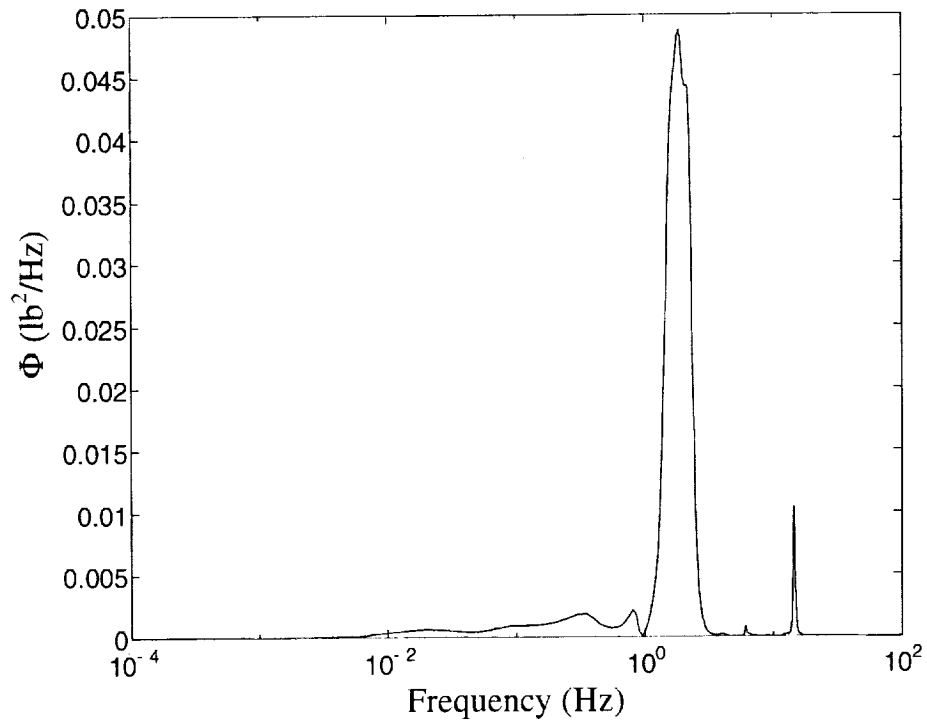


Figure 2.16: Power spectral density of V_1 at grid point 217.

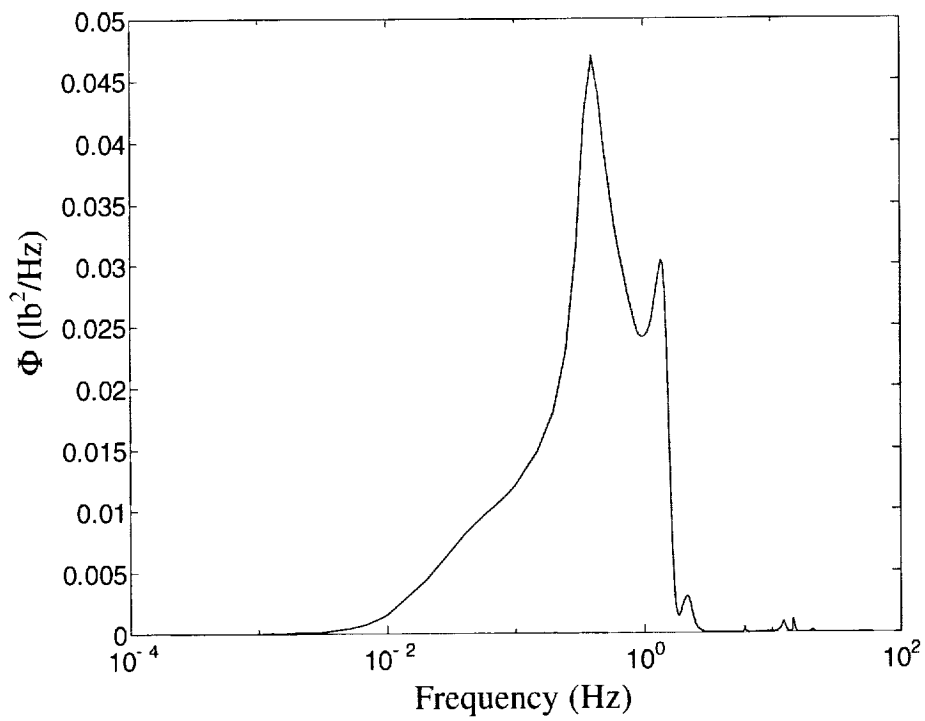


Figure 2.17: Power spectral density of V_2 at grid point 217.

The PSDs of the acceleration components of the center of gravity in the flow direction, A_1 , the vertical direction, A_3 , and about the pitching axis, A_5 , are shown in Figure 2.19-Figure 2.21, respectively. As expected, the highest acceleration magnitude is in the vertical direction. Additionally, the translational accelerations A_1 and A_3 , are affected by both bending and twisting modes. This is mainly because the center of gravity is offset horizontally from the elastic axis of the wing. The angular acceleration, A_5 , on the other hand, peaks mainly at the natural frequencies of the torsional modes. Similarly, accelerations A_1 , A_3 , and A_5 for point 140 are shown in Figure 2.22-Figure 2.24, and for point 217 in Figure 2.25-Figure 2.27.

Additional requested output quantities were the root mean square value (\bar{A}) of the responses and the expected rate of zero crossings with positive slope (N_0). These statistical quantities are important for failure and fatigue analyses. These quantities are summarized in Table 2-3.

In order to ascertain that the solutions were converged with respect to the frequency range analyzed and the number of modes used in the analysis, the number of modes used was increased from 20 to 32 with no significant changes in loads. This includes the response RMS values shown in Table 2-3. Also, note that in Figure 2.4-Figure 2.18, no significant loads exist above 20 Hertz, whereas flexible modes and excitation loads exist at frequencies three times greater.

Table 2-3: Summary of the probability parameters for response quantities.

Point number	Type of response	\bar{A}	N_0 (Hz)
101	M_1	92.91 (lb-in)	1.94
	M_2	153.4 (lb-in)	1.473
	V_1	0.375 (lb)	2.450
	V_2	0.952 (lb)	2.217
	T	44.29 (lb-in)	2.316
140	M_1	51.10 (lb-in)	1.988
	M_2	8.080 (lb-in)	2.528
	V_1	0.149 (lb)	4.154
	V_2	0.419 (lb)	3.220
	T	41.03 (lb-in)	1.962
217	M_1	50.22 (lb-in)	3.346
	M_2	40.12 (lb-in)	2.800
	V_1	0.234 (lb)	5.850
	V_2	0.219 (lb)	3.681
	T	6.103 (lb-in)	4.661

Where, \bar{A} = Root Mean Square value of the response.

N_0 = Expected number of zero crossings with positive slope per unit time

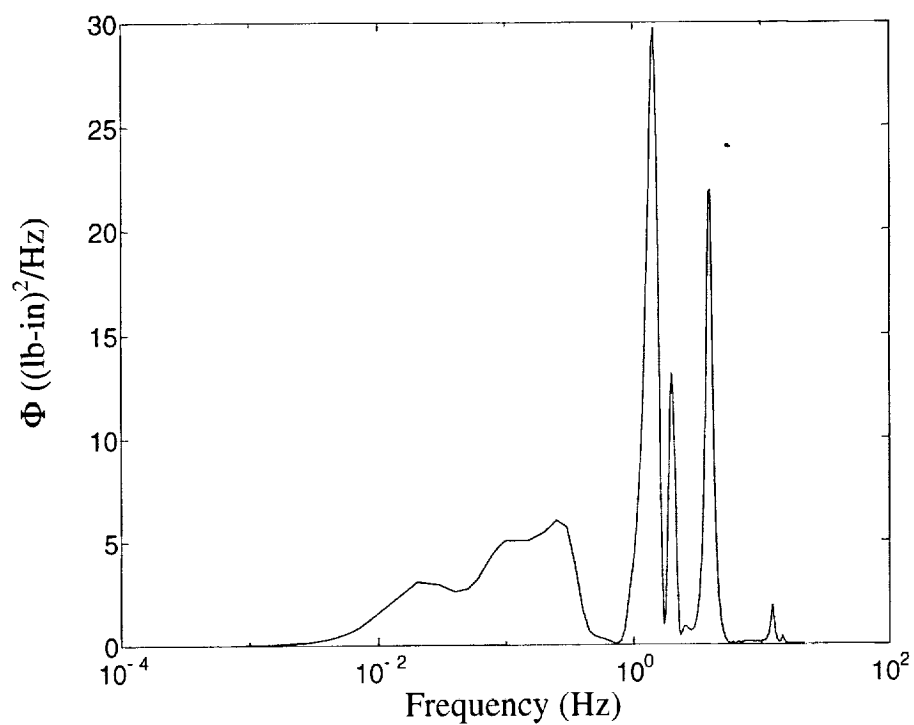


Figure 2.18: Power spectral density of T at grid point 217.

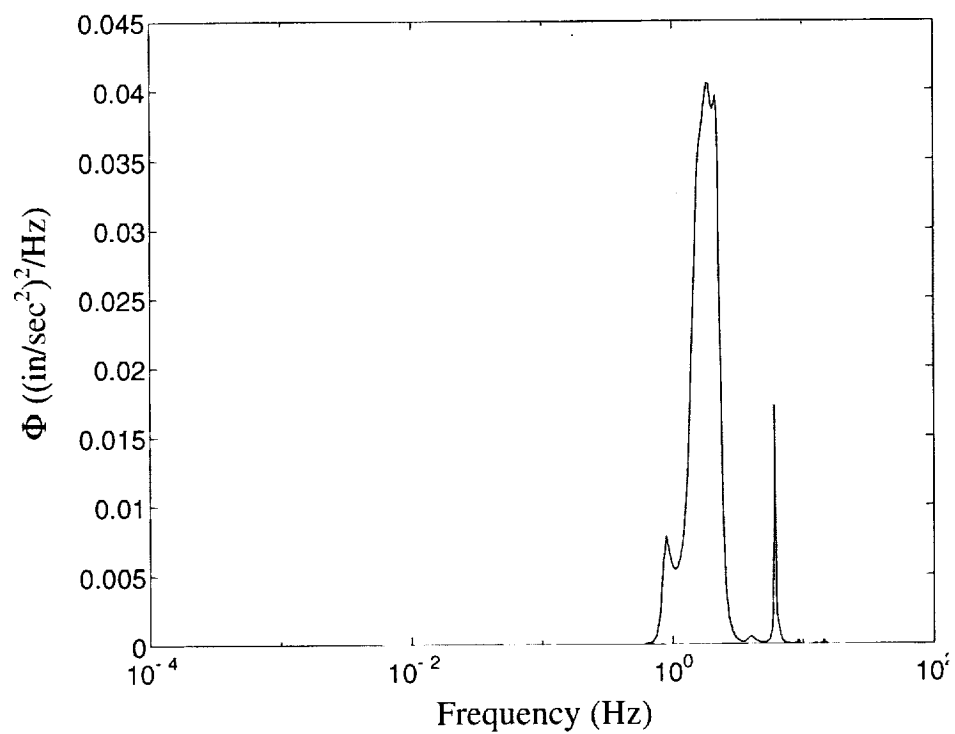


Figure 2.19: Power spectral density of acceleration A_1 for the center of gravity.

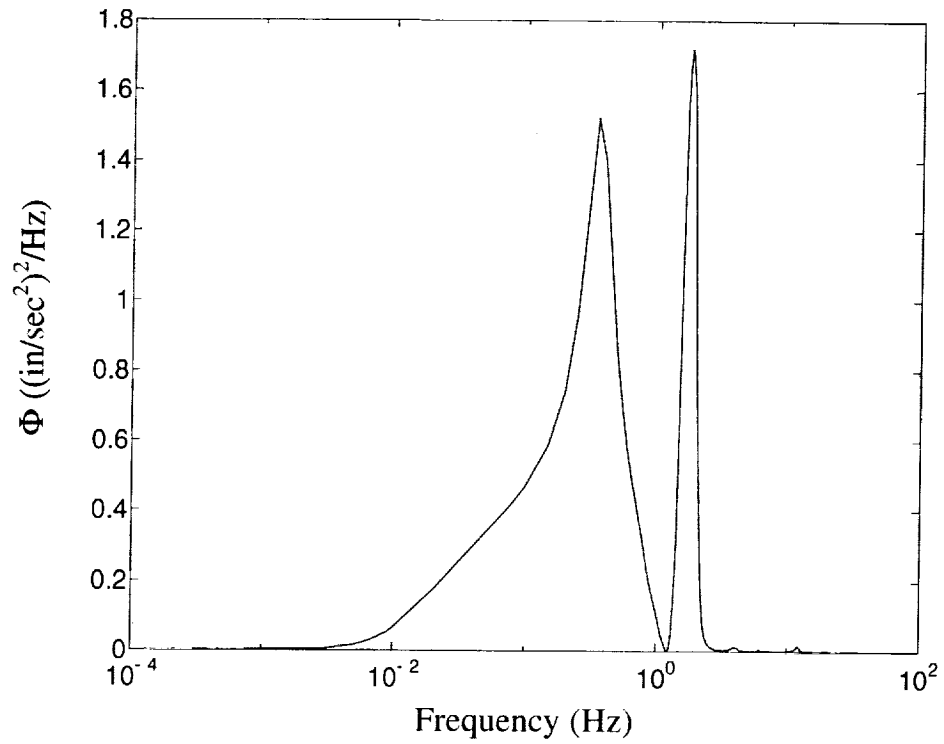


Figure 2.20: Power spectral the acceleration A_3 for the center of gravity.

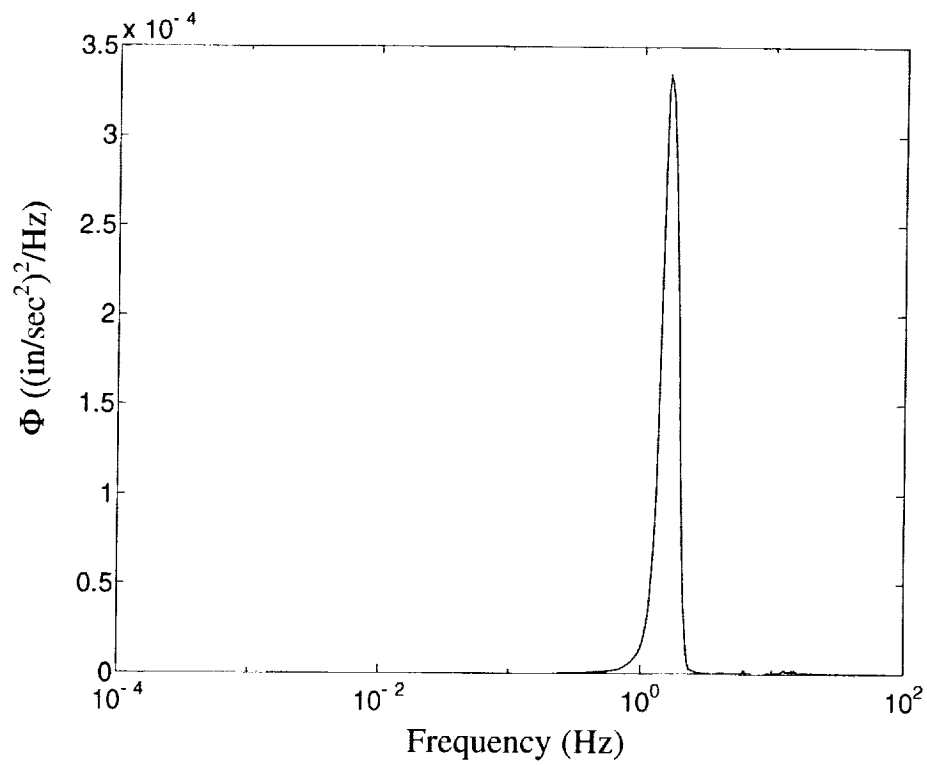


Figure 2.21: Power spectral the angular acceleration, A_5 , for the center of gravity.

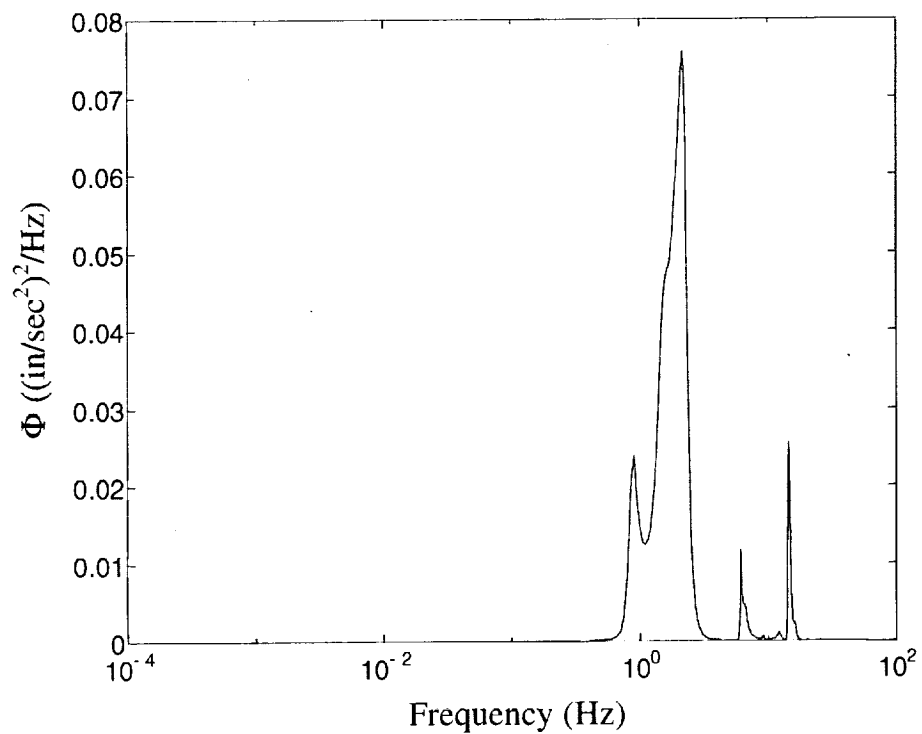


Figure 2.22: Power spectral density of the acceleration A_1 for point 140.

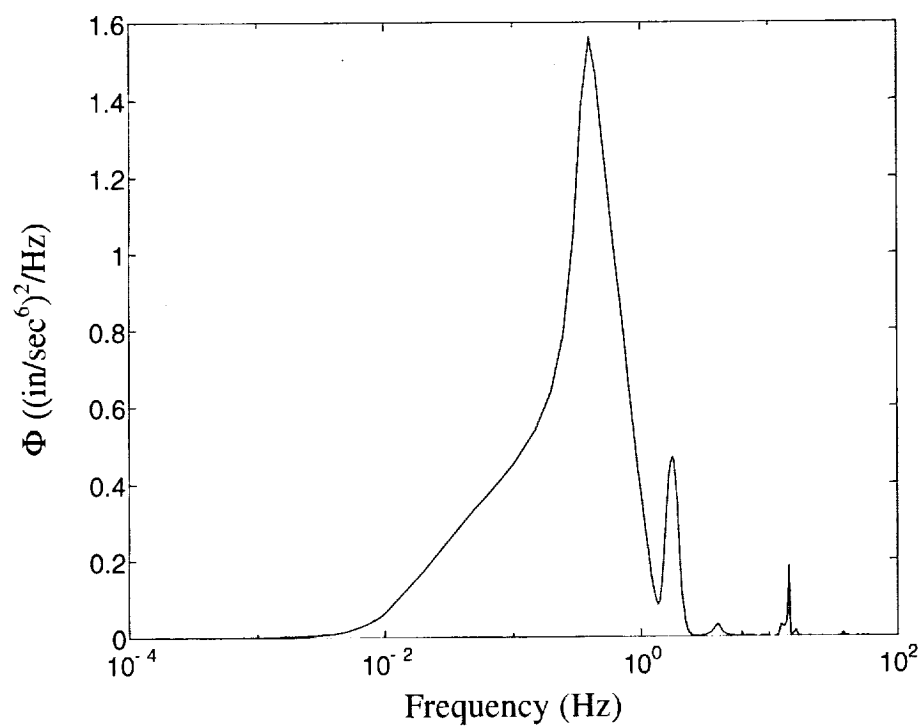


Figure 2.23: Power spectral density of the acceleration A_3 for point 140.

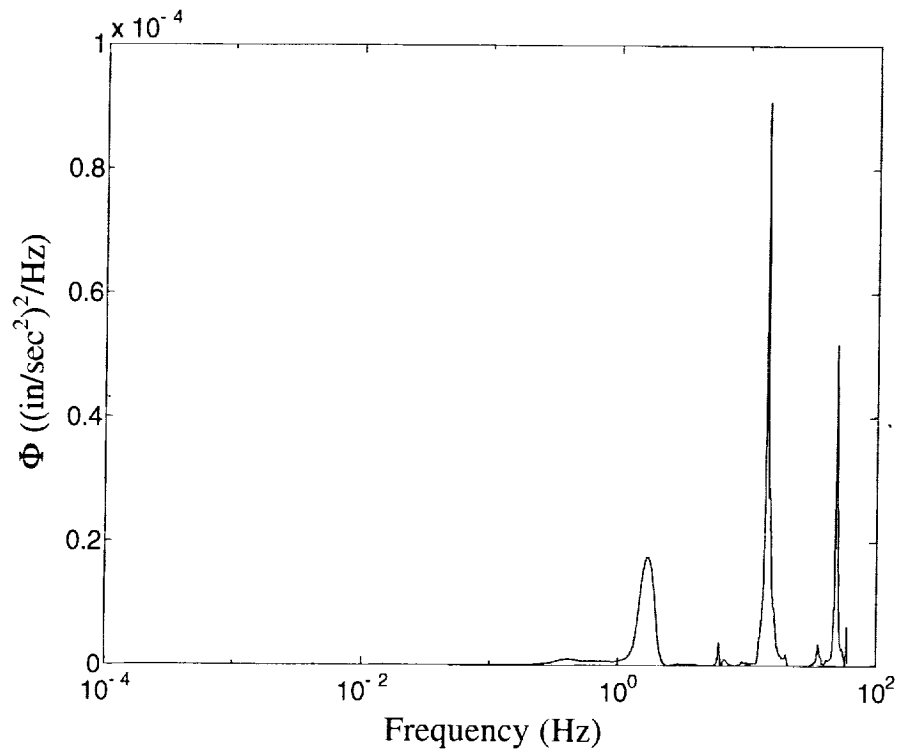


Figure 2.24: Power spectral density of the angular acceleration, A_5 , for point 140.

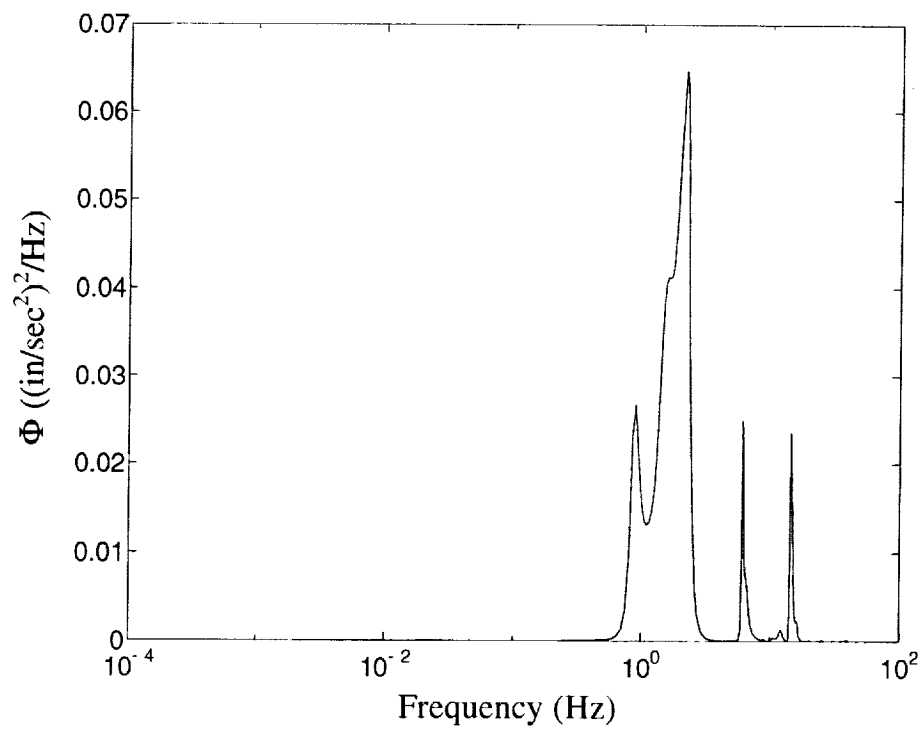


Figure 2.25: Power spectral density of the acceleration A_1 for point 217.

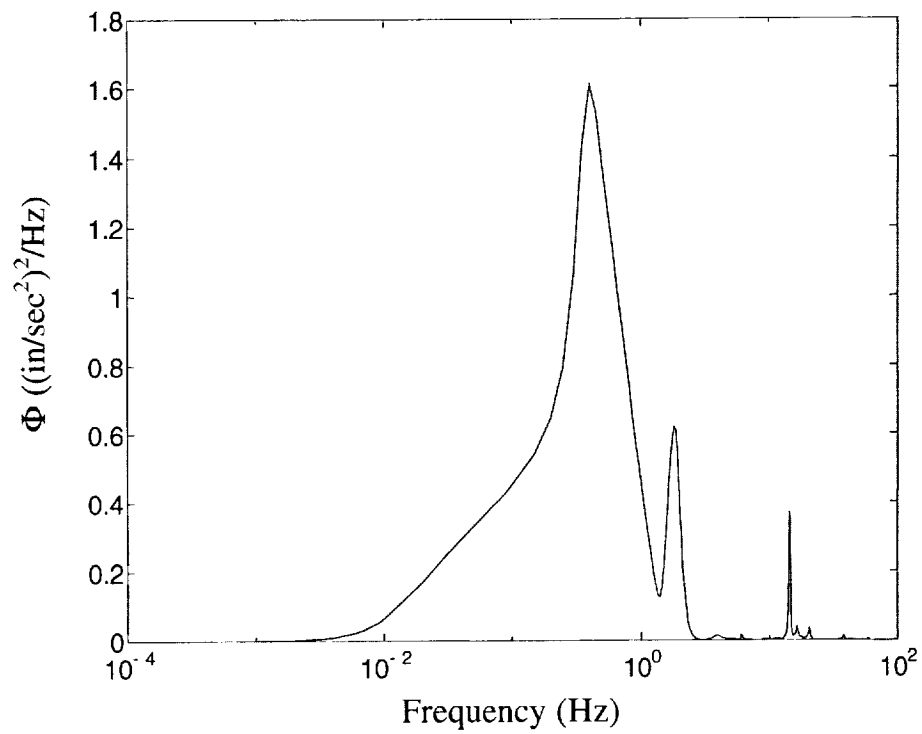


Figure 2.26: Power spectral density of the acceleration A_2 for point 217.

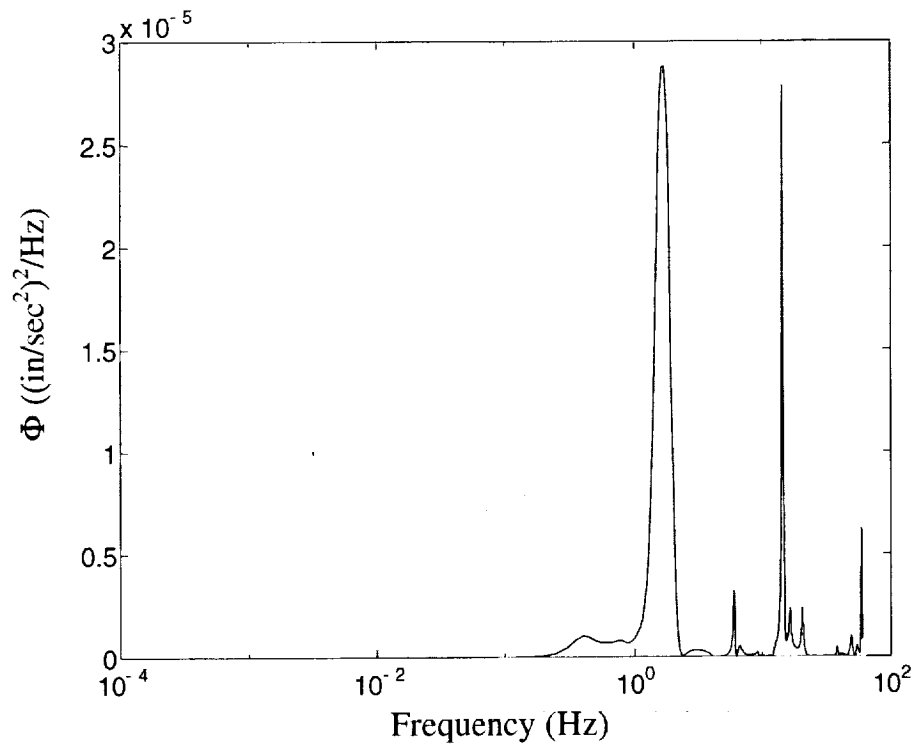


Figure 2.27: Power spectral density of the angular acceleration, A_1 , for point 217.

3 TWO-DIMENSIONAL PSD GUST ANALYSIS

3.1 Introduction

This section deals with the two dimensional PSD gust analysis which was the central issue addressed in the entire study. All of the other work was done in order to develop and validate the two-dimensional process, or to correlate and compare the two-dimensional results with one-dimensional results. The gust load was represented by the cross spectral density between correlation strips spanning the airplane and parallel to the flight direction. The full-span structural and aeroelastic FEMs described in Section 1 were used for the analysis. As the capability of MSC/NASTRAN is limited to aerodynamic analysis under uniform (one dimensional) gust loads, Direct Matrix Abstraction Program (DMAP)⁶ alters were introduced in the program to extract the frequency response functions (FRF) of the response from each of the correlation strips. One hundred and sixty (160) correlation strips were used, covering 1440 aerodynamic boxes. Programs written in MATLAB⁷ were used to generate the cross spectral matrices and perform the post processing of the data generated by MSC/NASTRAN. The input data requirements were generated for a single set of flight conditions. Using no restraints (free-free boundary conditions), 64 normal modes spanning a frequency band up to 60 Hertz were computed and included in the analysis. PSD of different response quantities such as accelerations, moments and torques at critical grid points of the structures are generated and plotted for a range of frequencies that covers the elastic modes of vibration. The flight conditions and response quantities investigated are identical to those in the one-dimensional analysis.

3.2 MSC/NASTRAN Input and Output

The desired total fuel weight was entered into the data deck distributed among 14 grid stations. A normal modes analysis (Solution 103) was performed to obtain the weight and center-of-gravity (CG) location and to determine the number of modes within a frequency band of 60 Hertz. For the full-span case, the CG is at the centerline, and both symmetric and anti-symmetric mode shapes are involved. Appendix D contains complete listings of the MSC/NASTRAN files used in the two-dimensional analysis.

The lifting surfaces of the airplane were represented by 1440 aerodynamic boxes used for the doublet-lattice method. Each row of aerodynamic boxes in the chord-wise direction was used to represent a correlation strip for the two dimensional gust analysis. A DMAP alter was written to calculate the frequency response functions under unit aerodynamic loads acting on the correlation strips. The DMAP alter loops through the correlation strips which are identified by direct matrix input (DMI) cards. It was necessary to run each side of the airplane separately because the version of MSC/NASTRAN used restricted the maximum number of DMI cards to 100. The input cards required for the MSC/NASTRAN analysis include:

FREQ2	Defines frequencies used in solution of the frequency response problems.
MKAERO	Defines a set of Mach numbers and reduced frequencies to be used in the generation of the frequency response function.

PARAM inputs required included:

NSTRIPRM	Specifies the number of strips to be analyzed.
LMODE	Specifies the number of lowest normal mode to include.
MACH	MACH number used to compute aerodynamic matrices.
Q	Specifies the dynamic pressure.

In the absence of experimental estimates for the structural damping as a function of frequency, a modal structural damping of 0.02 was assumed over the entire analysis band of 60 Hz.

The desired set of analysis parameters is selected by the MSC/NASTRAN Case Control inputs. These inputs include:

FREQUENCY	Selects a set of desired solution frequencies (FREQ2).
METHOD	To select the eigenvalue extraction method (EIGR).
RANDOM	Selects the power spectral density factors (RANDPS) for the uniform case.
SDAMPING	Selects the desired modal damping (TABDMP1).

A SUPORT card was used to insure that the rigid-body modes have exactly zero frequencies.

XYPRINT specifications were required to create printouts of the FRFs from each strip. The output was chosen to be in the form of a "punch file". The MATLAB programs used in the post processing can, however, read "f06" files as well.

3.3 MATLAB Input and Output

MATLAB programs were written to generate the gust load cross-spectral matrices at each frequency, read the FRFs generated by MSC/NASTRAN, and calculate the power and cross-spectral densities of the responses. The input lists are contained in appendix E. The user needs to run only the program called "calc_response.m" with no input parameters. This program will call all the necessary programs to calculate the responses and their statistics. The cross-spectral density ϕ_{12} of the gust loads for two correlation strips is calculated according to reference 3 using the following equation:

$$\phi_{12}(\omega) = \frac{\sigma_w^2}{\sqrt{2\pi}} \frac{2^{2/3}}{\Gamma(1/3)} \frac{L}{V} \left(\frac{1}{1.339}\right)^{8/3} \left[\frac{8}{3} (1.339)^2 \frac{\sigma^{5/3}}{z^{5/6}} K_{5/6}(z) - \frac{\sigma^{1/3}}{z^{1/6}} K_{1/6}(z) \right] \quad (3.1)$$

where:

$$z = \frac{\sigma}{1.339} \sqrt{1 + (1.339\nu)^2}, \quad (3.2)$$

$$\nu = \frac{\omega L}{V},$$

$$\sigma = \frac{s}{L},$$

s is the separation distance between the two strips,

L is the gust scale length,

σ_w is the rms value of the gust speed, and

K_i is the modified Bessel function of the second kind of order i .

The values of these variables are entered in a data file called "case_info.data". This file is read by the program "calc_response.m". Other information in the "case_info.data" file includes the name of the punch or "f06" file that has the FRF data, the number of frequency points used in the MSC/NASTRAN analysis,

the number of response quantities analyzed, and the number of correlation strips used in the analysis. A family of cross-spectral densities of the gust load is shown in Figure 3.1.

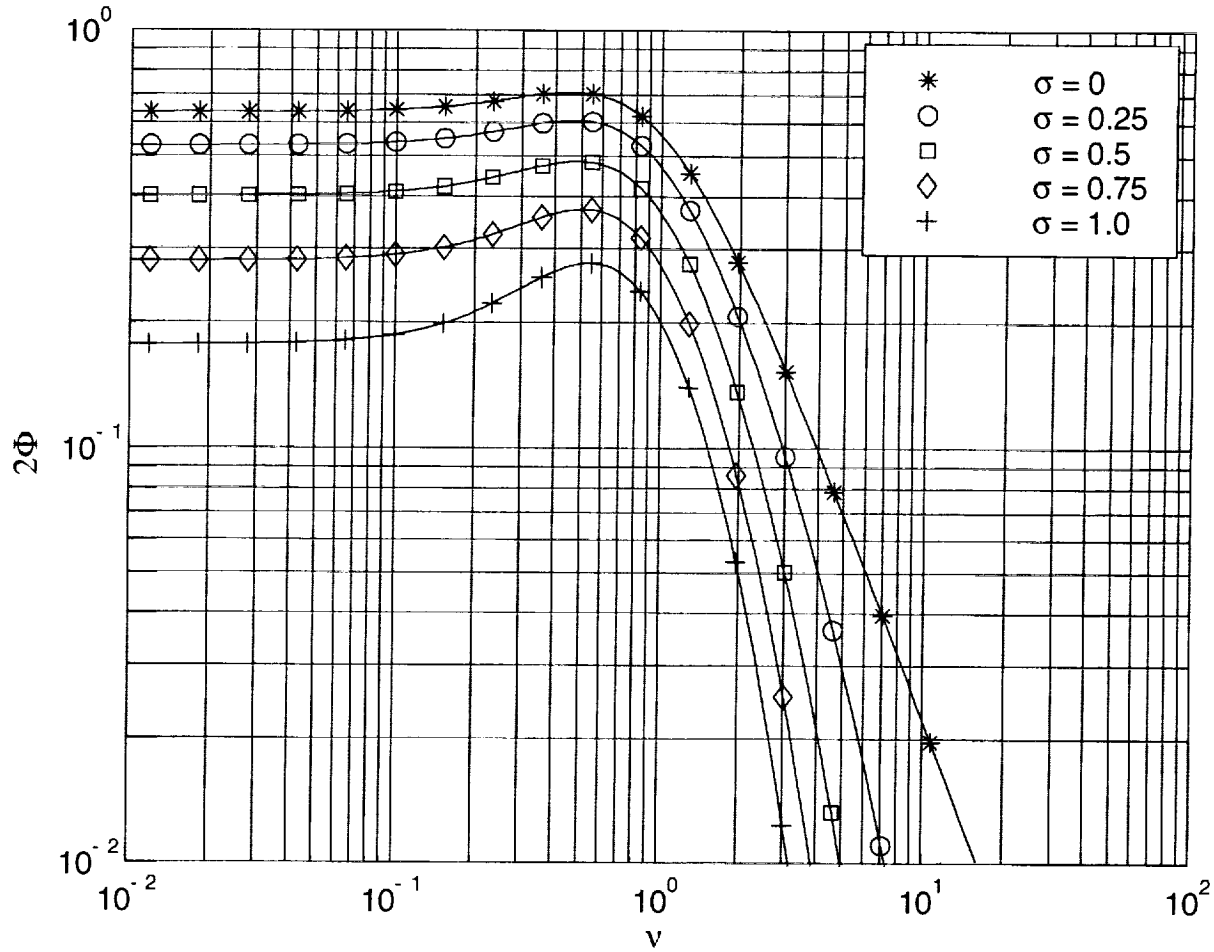


Figure 3.1: Non-dimensional gust cross-spectral spectral density for various non-dimensional separation distances.

The Matlab program “calc_resp.m” generates the following output quantities in order:

- The frequency vector,
- The auto power spectral matrix whose columns are the PSD vectors for each response quantity,
- A three-dimensional array for the cross-spectral matrices,
- The root-mean-square (RMS) values of the responses,
- The expected number of positive slope zero-crossings (N_0) of the responses.

The cross-spectral matrix of the response quantities is calculated in terms of the FRF matrix and the cross-spectral matrix of the gust load according to the following equation (reference 8):

$$[\phi_r(\omega)] = [H'(\omega)][\phi_g(\omega)][H(\omega)] \quad (4.2)$$

where ϕ_r is the cross-spectral matrix of the responses,

ϕ_g is the spectral-spectral matrix of the gust load,

H is the FRF matrix, and

H' is the complex conjugate transpose of H .

3.4 Verification of the Procedure

To verify the procedure used in the calculation of the non-uniform gust case, the procedure was first used to calculate the response to a uniform gust. This was done by setting the separation distances between all the strips to zero. This means that the cross-spectral density and the auto-spectral density is the same and is equal to the gust spectral density in the uniform gust case. The results of this procedure were compared to the results obtained directly from the MSC/NASTRAN uniform gust analysis. Both sets of results were identical. The figures plotted in this report for the uniform case were generated using this procedure. The results obtained directly from MSC/NASTRAN gust analysis were not plotted because they are an exact match of the results from the new procedure.

For further verification of the procedure used in this section, The present procedure was used to perform two-dimensional gust analysis on the jet transport wing used by Bisplinghoff, Ashley, and Halfman in reference 2, which is known in the literature as the BAH wing. The results of the present method are compared with the results reported by Crimaldi, Britt, and Rodden in reference 8.

3.4.1 Finite Element Model of the BAH Wing

The BAH full span wing was developed by modifying the half-span example in the MCS/NASTRAN example directory (reference 2) to produce a model similar to that used Crimaldi et al⁹. The right-hand wing in the example, which consisted of GENEL elements and concentrated masses, was mirrored into the left-hand side to produce the full-span wing (Figure 3.2). The GENEL elements are constrained so that the wing can only have roll, pitch, and plunge rigid body degrees of freedom. The fuselage weight was divided in half and carried by two very stiff beams 45 inches away from the center to each side. In addition, the connection point in the middle of the fuselage was broken into two co-incident points connected by very stiff beams in order to generate the center moment from the beam stresses. This was done because structural loads cannot be recovered from GENEL elements. The structural model is shown in figure 1. The total span of the wing is 500 ft and the its total area is 162,500 in². The root chord is 100 inches and the chord at the three-quarter span is 131.2 inches. The total weight is 83,838 lb., of which 34,800 lb. is the fuselage weight.

For the aerodynamic model (Figure 3.3), the surface of the wing was divided into a lattice of 12X5 aerodynamic boxes for use with doublet-lattice method. Those boxes are splined with the grid points of the structural model. To calculate the frequency response function under non-uniform gust loads, eleven correlation strips were formed from the rows of aerodynamic boxes spanning the whole wing. The two rows of aerodynamic boxes in the middle of the wing are lumped into one correlation strip representing the fuselage. The aerodynamic model with the grid points for the splines is shown in Figure 3.3. The MSC/NASTRAN structural and aerodynamic input file can be found in Appendix F.

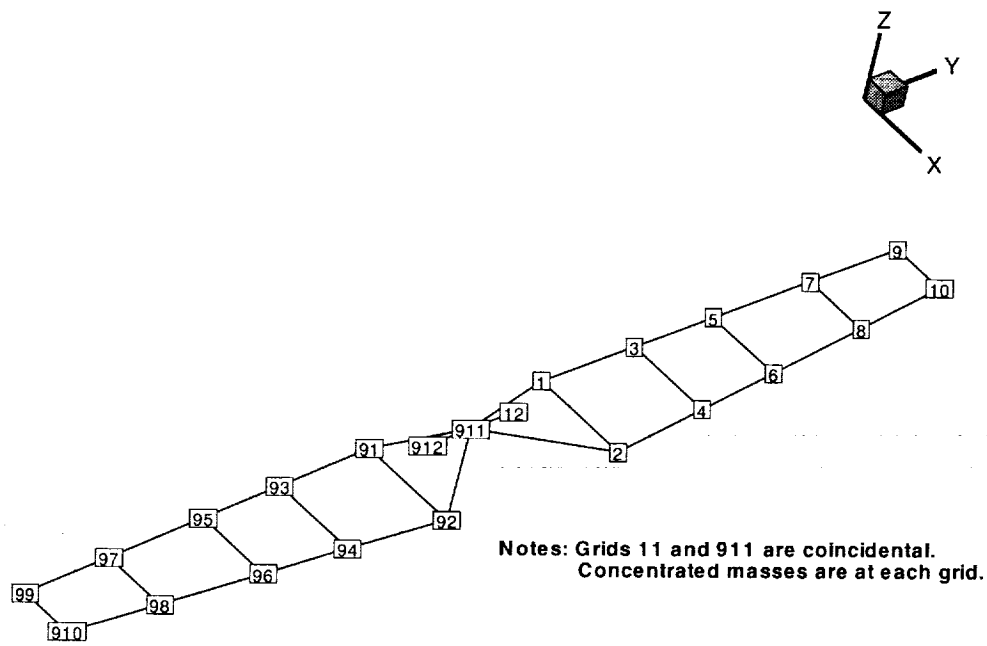


Figure 3.2: Structural model of the full-span BAH wing.

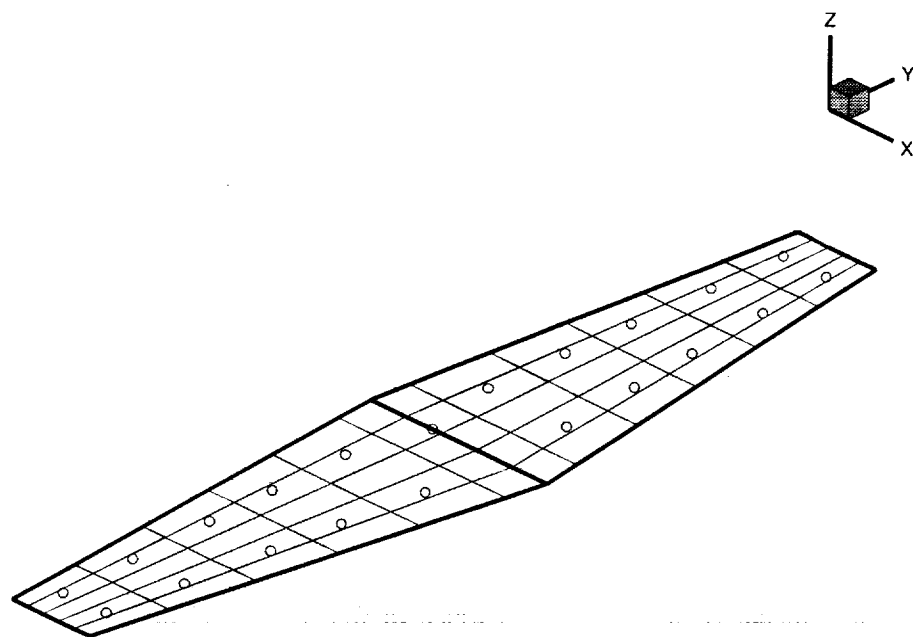


Figure 3.3: Aerodynamic model of the full-span BAH wing.

3.4.2 Results of the BAH Two-Dimensional Gust Analysis

Normal mode analysis was performed on the structural model to verify the free vibration characteristics of the wing. The first 13 mode shapes and natural frequencies, which are the ones included in the FRF analysis, are shown in Figure 3.4. These results are in exact agreement with the natural frequencies and mode shapes reported in reference 9.

The power spectral density (PSD) of the centerline acceleration for the uniform and non-uniform gust cases is shown in Figure 3.5. This figure is also an exact match to the results of reference 9. It is noted that the response to a non-uniform gust is higher than the response to uniform gust at high frequencies. At low frequencies, however, the uniform response is higher. The root mean square value \bar{A} and the expected value of the positive slope zero-crossing rate (N_0) of the accelerations under uniform and non-uniform gust loads were also calculated. The results of the present method are compared to the results of reference 8 in Table 3-1 and Table 3-2 for the RMS and zero crossing rates, respectively.

PSD plots for the tip acceleration and the centerline bending moment are shown in Figure 3.6 and Figure 3.7, respectively. It is noticed from the comparison of the RMS values from the current study and reference 9 that while the centerline acceleration is exactly the same (within reasonable round off error), the results of the tip acceleration and the centerline moment are different. This can be explained by the fact that the centerline acceleration is the only quantity that is calculated for the same exact point in the two studies. The tip acceleration in reference 9 is calculated for the edge of the middle aerodynamic box at the end of the wing, whereas the tip acceleration calculated here is for grid point 10, which is removed a little from the edge of the aerodynamic box. Since the objective here is to validate present method, it was used in the same way as for the Alliance 1 airplane. The comparison of the results at points other than grid points is beyond the scope of the current task.

Table 3-1: Comparison of the RMS values of the responses of the BAH wing.

Response	Uniform		Non-uniform	
	Current	Reference 9	Current	Reference 9
Centerline acceleration	4.74 E-2	4.74 E-2	4.42 E-2	4.44 E-2
Tip acceleration	0.188	0.180	0.168	0.173
Centerline moment	2.61 E+5	2.32 E+5	2.30 E+5	2.04+E5

Table 3-2: Comparison of the zero crossing rates of the responses.

Response	Uniform		Non-uniform	
	Current	Reference 9	Current	Reference 9
Centerline acceleration	2.34	2.30	2.56	2.57
Tip acceleration	3.77	3.68	4.87	4.82
Centerline moment	2.05	2.02	2.06	1.99

The results for the center-line moments are calculated in the current study from the internal stresses of the structural elements, similar to the method used for the Alliance 1 airplane. This was the reason for the introduction of the stiff beam elements to connect the two coincidental grid points at the center of the wing. Calculating the moments (loads in general) for points or sections on elements other than real structural elements, as in the current example, requires the calculation of integral functions of the aerodynamic loads and inertial forces at that section. This is also beyond the scope of the current task.

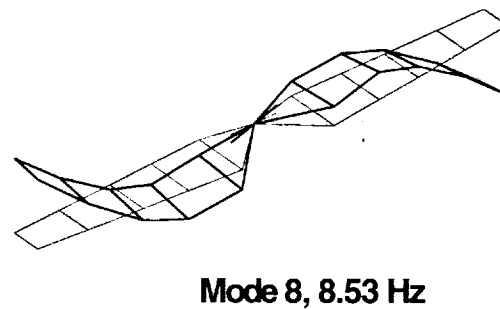
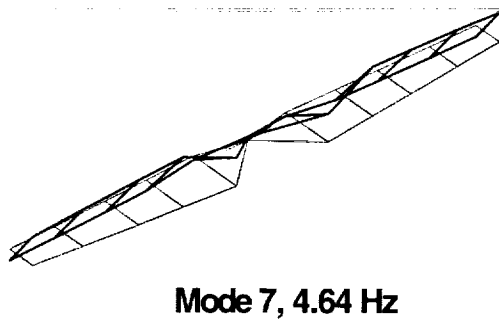
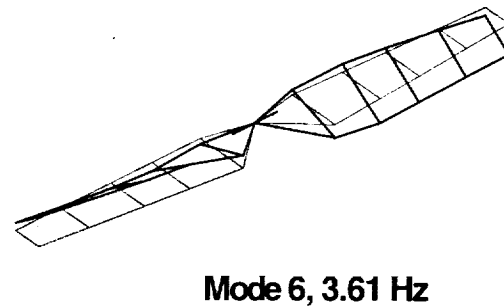
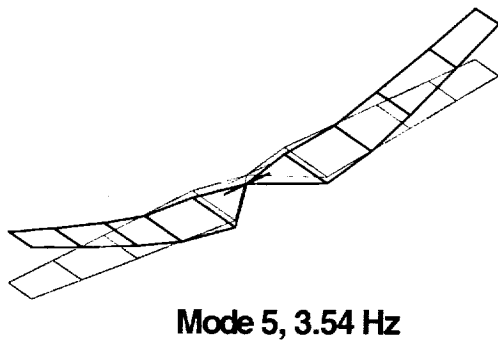
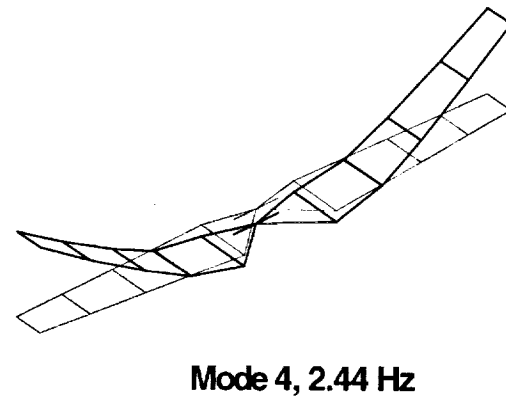
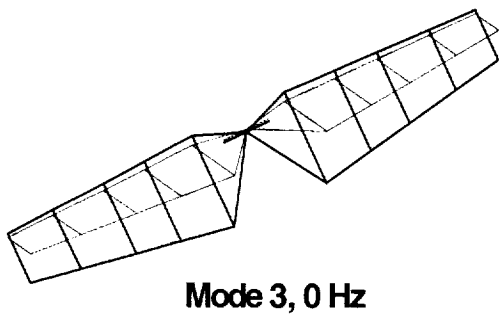
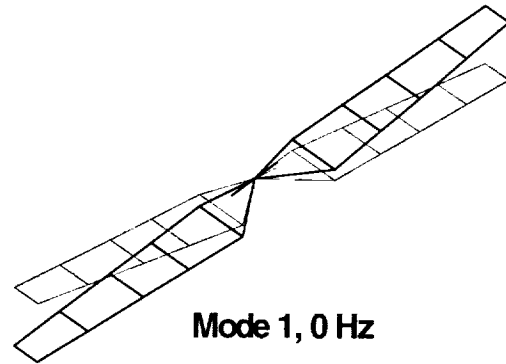
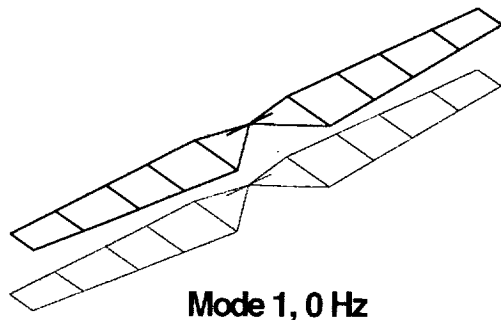
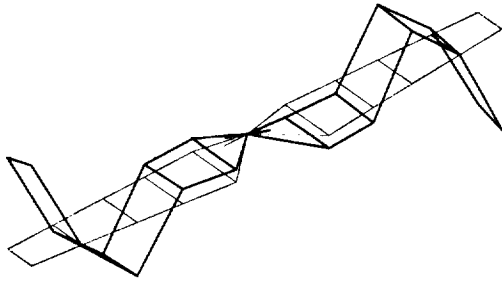
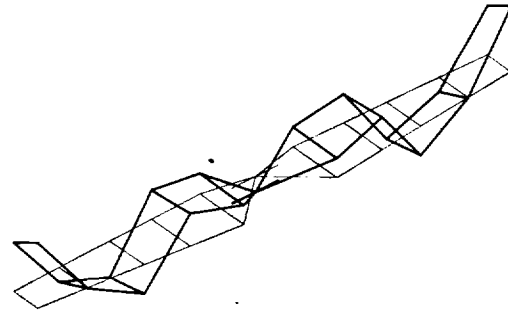


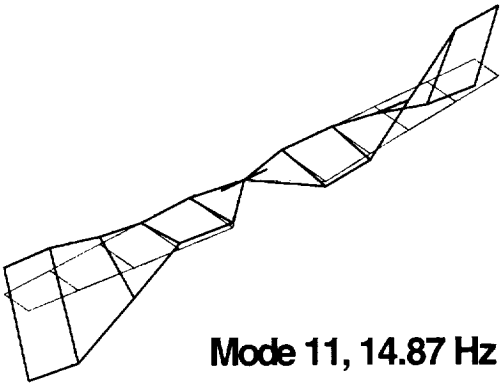
Figure 3.4: Mode shapes and natural frequencies of the BAH wing.



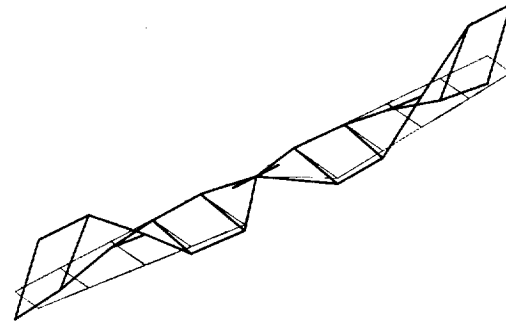
Mode 9, 10.60 Hz



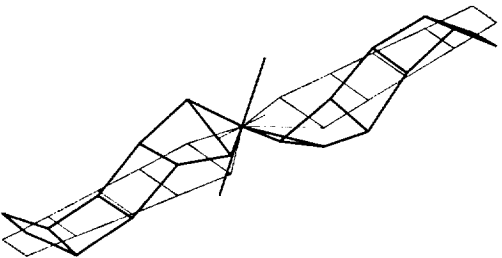
Mode 10, 12.68 Hz



Mode 11, 14.87 Hz



Mode 12, 14.88 Hz



Mode 13, 19.50 Hz

Figure 3.4: Mode shapes and natural frequencies of the BAH wing (concluded).

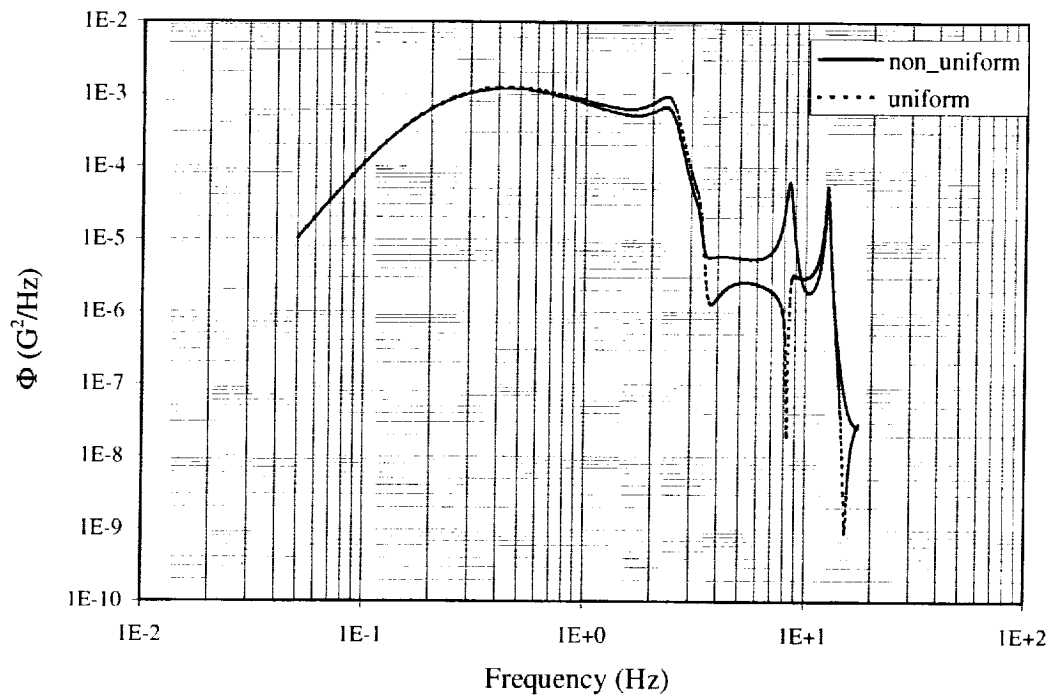


Figure 3.5: Power spectral density of the centerline acceleration of the BAH wing.

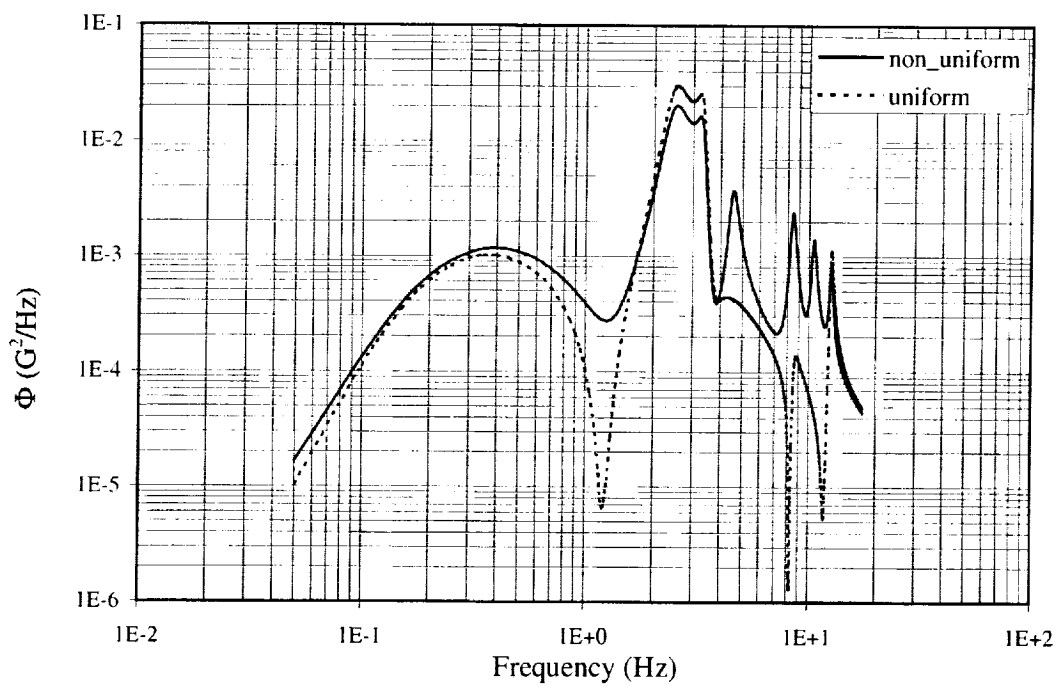


Figure 3.6: PSD of the acceleration of grid point 10 near the wing tip of the BAH wing.

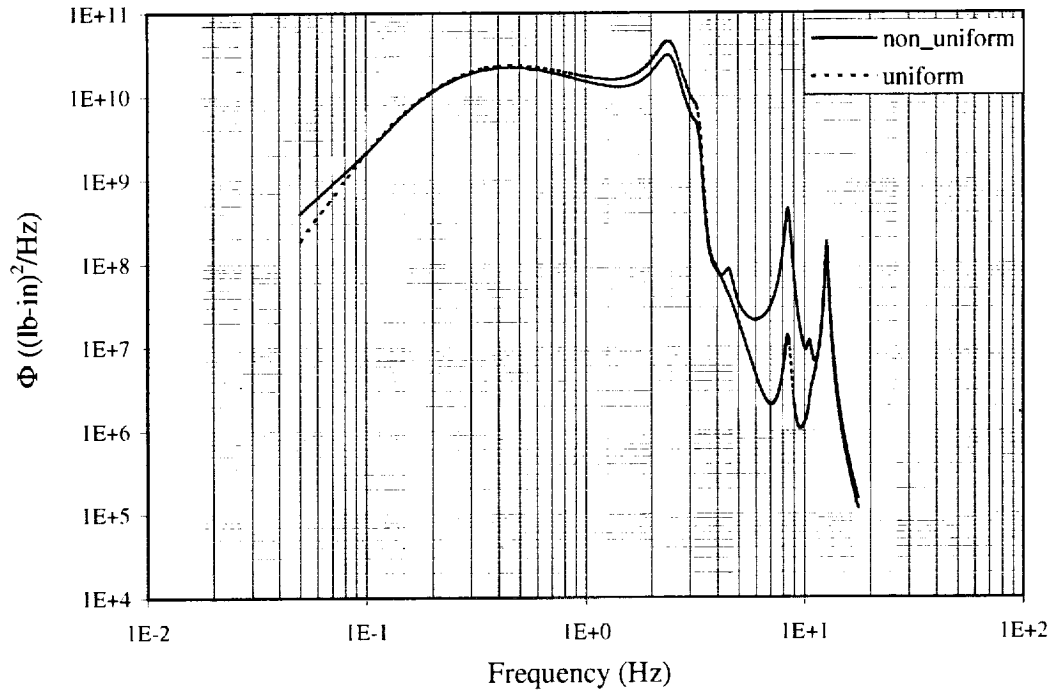


Figure 3.7: PSD of the centerline bending moment of the BAH wing.

3.5 Results and Discussion of the Two-Dimensional Analysis

A summary of the weight and the location of the CG with respect to the basic coordinate system is given in Table 3-3. Table 3-4 shows the lowest 64 natural frequencies of the structure. The first 6 modes are rigid-body modes. All rigid-body and elastic mode shapes are plotted in Figure 3.8. It should be noted that the anti-symmetric and symmetric mode shapes and frequencies start to converge at higher frequencies (mode 45 and above). This numerical behavior indicates degeneracy in the finite-element model. It is unreasonable to expect sufficient fidelity to accurately predict 64 mode shapes for such a model.

The excitation frequencies used in the frequency response solution ranged from 0.01 Hz to 50.0 Hz and were specified on FREQ2 data cards, which use a logarithmic distribution for the frequencies. Figure 3.1, shown earlier, presents the cross-power spectral density over this total frequency band for several separation distances. The roll-off frequency gets smaller as the separation distance increases.

Table 3-3: Weight summaries for the full-span model with respect to the basic coordinate system.

Weight (lb)	X-C.G (in)	Y-C.G (in)	Z-C.G (in)
2.094578E+03	160.95	0.0	77.09

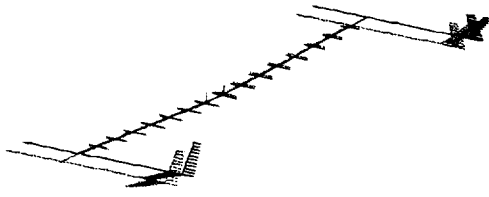
Table 3-4: Natural frequencies of the modes included in the dynamic response analysis.

Mode #	Frequency (Hz)	Mode #	Frequency (Hz)	Mode #	Frequency (Hz)	Mode #	Frequency (Hz)
1	0.0000	17	4.1273	33	15.3397	49	38.7357
2	0.0000	18	5.1496	34	15.3545	50	38.7454
3	0.0000	19	6.1176	35	16.7184	51	40.0690
4	0.0000	20	6.7502	36	17.1604	52	40.4588
5	0.0000	21	7.0150	37	21.3164	53	43.8788
6	0.0000	22	8.3149	38	21.7041	54	43.9072
7	0.3804	23	8.3449	39	23.9172	55	44.9486
8	0.5778	24	9.0024	40	25.1920	56	44.9588
9	0.8129	25	9.2734	41	26.4514	57	50.4323
10	1.0502	26	10.8704	42	26.5199	58	50.4640
11	1.2899	27	10.9832	43	31.5077	59	51.7589
12	1.6263	28	12.0318	44	31.6183	60	52.3631
13	2.0371	29	12.8431	45	31.9269	61	55.8226
14	2.2012	30	13.8056	46	31.9337	62	55.8527
15	3.5555	31	14.6001	47	36.8595	63	59.5701
16	4.1178	32	14.8595	48	36.9357	64	59.5705

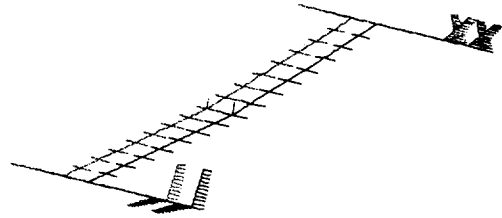
PSD of the bending moment in the vertical plane, M_1 , for grid point 101 is plotted in Figure 3.9. PSD of M_2 , V_1 , V_2 , and T for the same grid point are shown in Figure 3.10-Figure 3.13, respectively. The largest response for M_2 occurs at a frequency of about 0.4 Hz, which is the frequency of the first elastic mode. A large response of the bending moment at this frequency, especially when the PSD of the excitation is significant in that vicinity is expected. A smaller peak of M_2 response occurs at a frequency of 2 Hz which is the natural frequency of the second bending mode of the wing. Higher modes do not appear to influence the bending moment response. Moment M_1 has a large and sharp peak at about 2 Hz with multiple smaller peaks at lower frequencies. This small peaks can be attributed to the coupling between the responses in planes 1 and 2. The PSD of the torque at this point has peaks at 0.4 Hz, which is the frequency of the first elastic mode, and 1.6 Hz, which are the natural frequency of the torsional mode of the wing. It is generally noticed from all these figures that the non-uniform response is higher than the uniform at low frequencies and smaller at high frequencies. This can be attributed to the fact that the high magnitude influence for the cross power spectral density of the loads is concentrated in the lower frequency range for non-uniform case and decreases at higher frequencies.

Results similar to Figure 3.9-Figure 3.13 are shown in Figure 3.14-Figure 3.18 for a grid point 140 (on the right wing elastic axis at a span fraction of 97.50%). Another set of results is also shown in Figure 3.19-Figure 3.23 for grid point 217 (at the right wing tip boom 0.373 inches forward of intersection of the wing elastic axis and the tip boom). The peaks of the different loads for each of the points studied vary depending on the location and type of response examined.

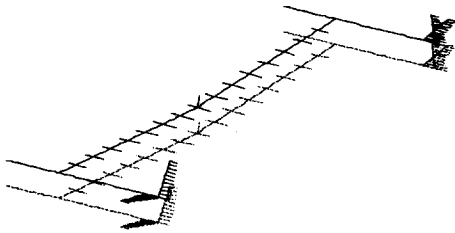
The variation along the span of the root-mean-square (RMS) values of the bending moment M_2 and vertical shear force V_2 are presented in Figure 3.24 and Figure 3.25, respectively. The RMS values of M_2 under non-uniform gust is higher than that under uniform gust. The difference in these values is greater in the mid-span region. The RMS values of the shear force V_2 , on the other hand, are closer to each other near mid-span, with the response to a non-uniform gust being greater for some region and smaller in another.



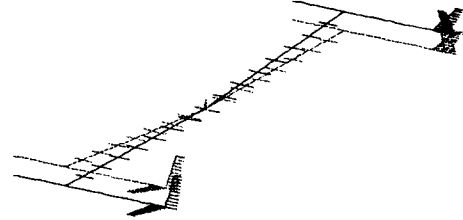
Mode shape no. 1 at 0.0 Hz



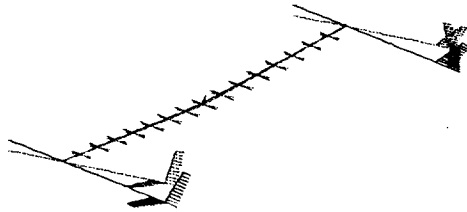
Mode shape no. 2 at 0.0 Hz



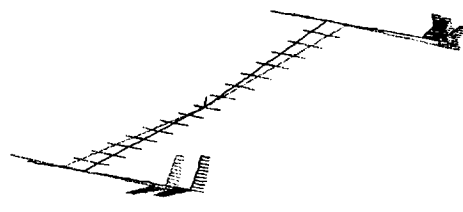
Mode shape no. 3 at 0.0 Hz



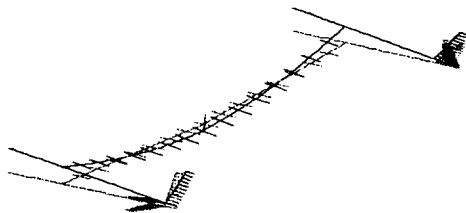
Mode shape no. 4 at 0.0 Hz



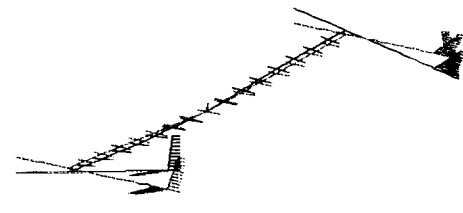
Mode shape no. 5 at 0.0 Hz



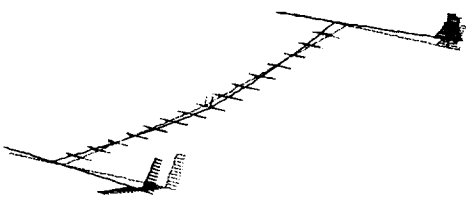
Mode shape no. 6 at 0.0 Hz



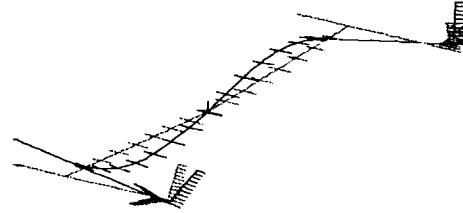
Mode shape no. 7 at 0.3804 Hz



Mode shape no. 8 at 0.5778 Hz

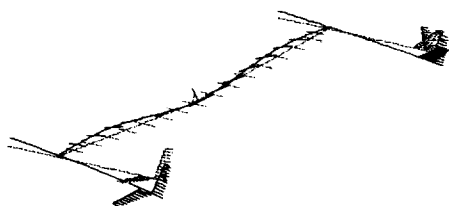


Mode shape no. 9 at 0.8129 Hz

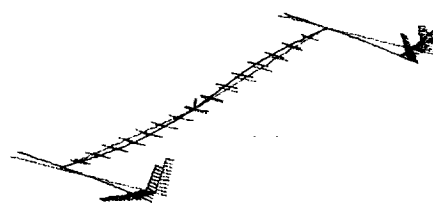


Mode shape no. 10 at 1.050 Hz

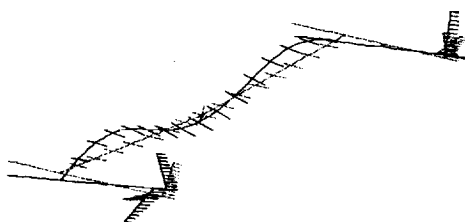
Figure 3.8: Mode shapes and natural frequencies for the two-dimensional gust analysis.



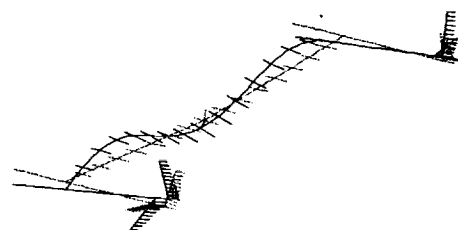
Mode shape no. 11 at 1.290 Hz



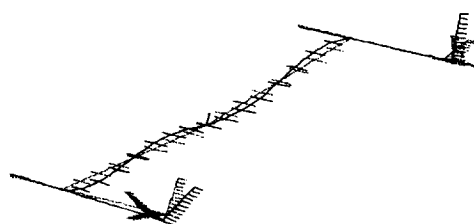
Mode shape no. 12 at 1.626 Hz



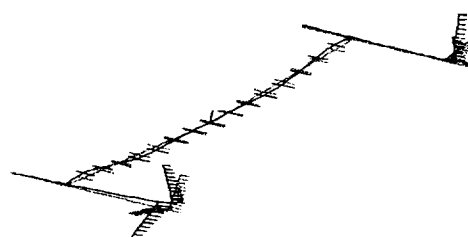
Mode shape no. 13 at 2.037 Hz



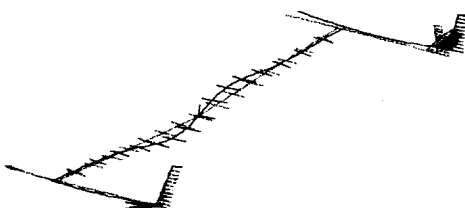
Mode shape no. 14 at 2.201 Hz



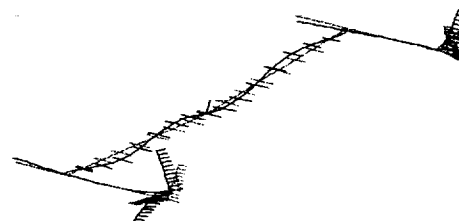
Mode shape no. 15 at 3.556 Hz



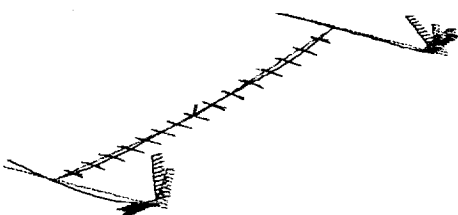
Mode shape no. 16 at 4.118 Hz



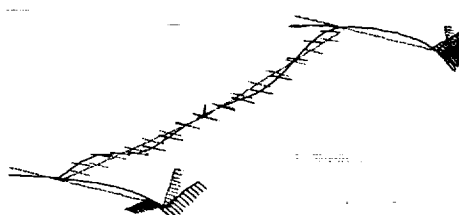
Mode shape no. 17 at 4.127 Hz



Mode shape no. 18 at 4.150 Hz

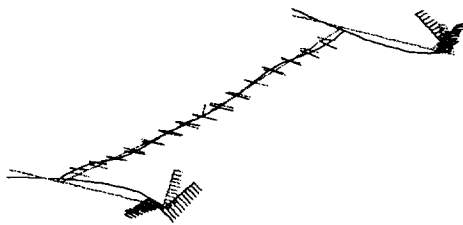


Mode shape no. 19 at 6.118 Hz

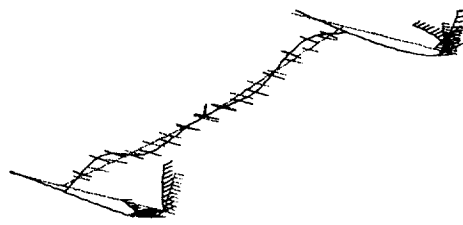


Mode shape no. 20 at 6.750 Hz

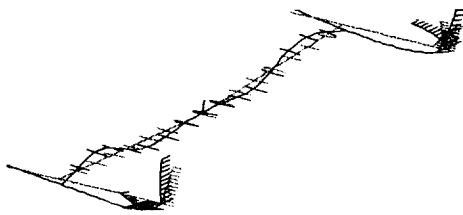
Figure 3.8: Mode shapes and natural frequencies for the two-dimensional gust analysis (continued).



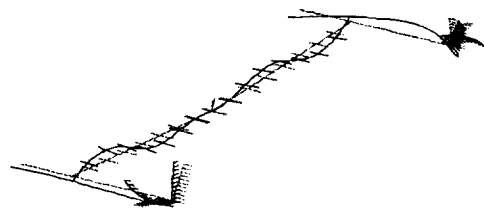
Mode shape no. 21 at 7.015 Hz



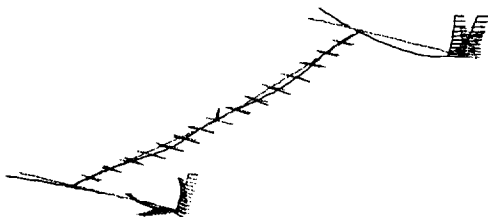
Mode shape no. 22 at 8.315 Hz



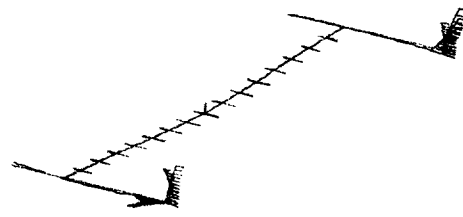
Mode shape no. 23 at 8.345 Hz



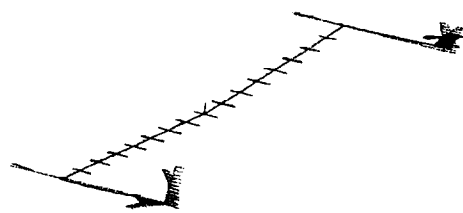
Mode shape no. 24 at 9.002 Hz



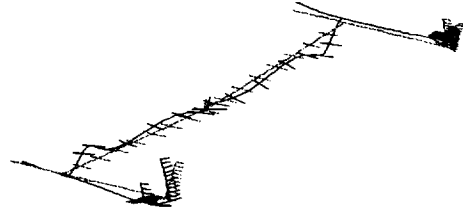
Mode shape no. 25 at 9.273 Hz



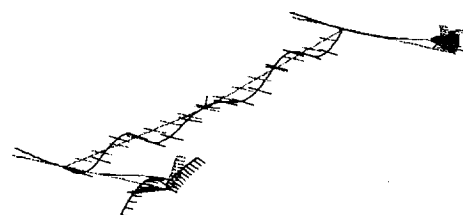
Mode shape no. 26 at 10.87 Hz



Mode shape no. 27 at 10.98 Hz



Mode shape no. 28 at 12.03 Hz

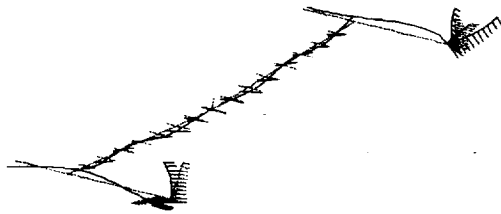


Mode shape no. 29 at 12.84 Hz

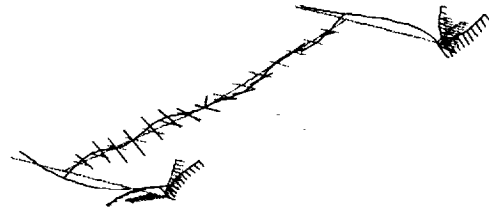


Mode shape no. 30 at 13.81 Hz

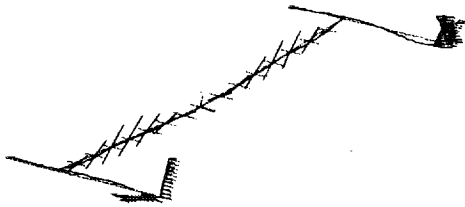
Figure 3.8: Mode shapes and natural frequencies for the two-dimensional gust analysis (continued).



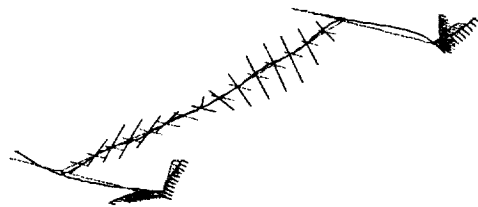
Mode shape no. 31 at 14.60 Hz



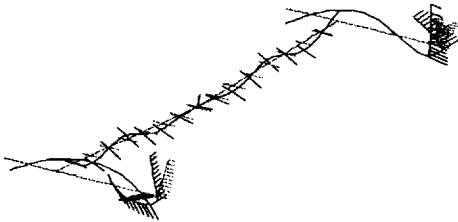
Mode shape no. 32 at 14.86 Hz



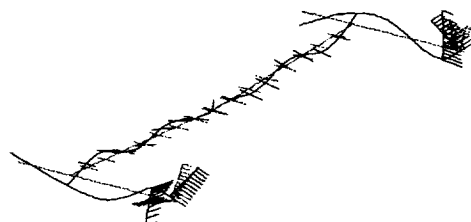
Mode shape no. 33 at 15.34 Hz



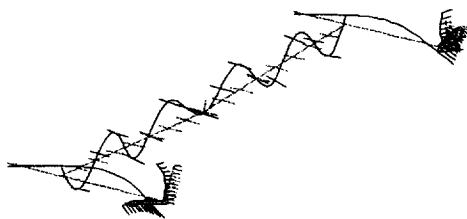
Mode shape no. 34 at 15.35 Hz



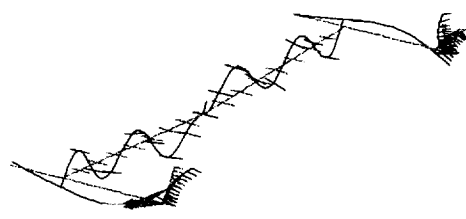
Mode shape no. 35 at 16.72 Hz



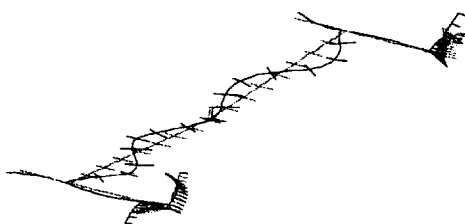
Mode shape no. 36 at 17.16 Hz



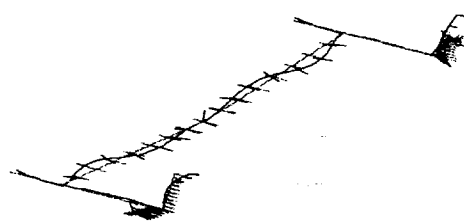
Mode shape no. 37 at 21.32 Hz



Mode shape no. 38 at 21.70 Hz

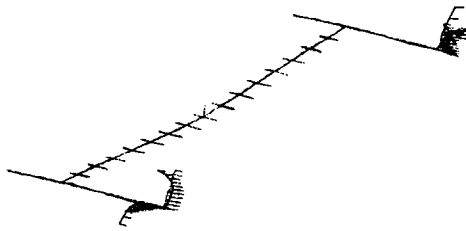


Mode shape no. 39 at 23.92 Hz

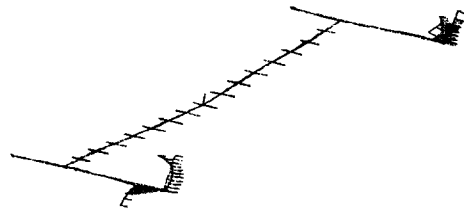


Mode shape no. 40 at 25.19 Hz

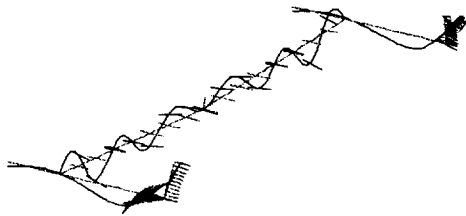
Figure 3.8: Mode shapes and natural frequencies for the two-dimensional gust analysis (continued).



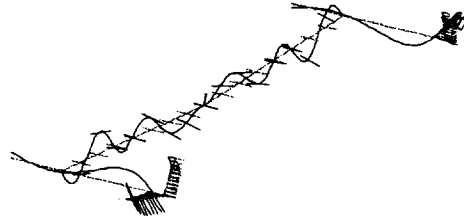
Mode shape no. 41 at 26.45 Hz



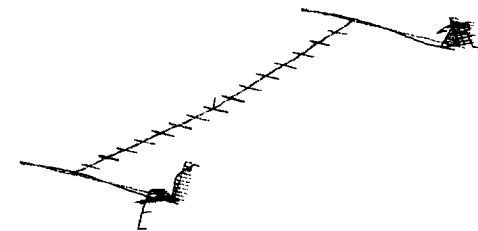
Mode shape no. 42 at 26.52 Hz



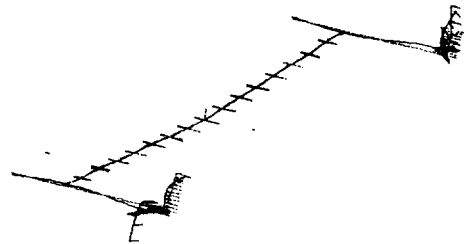
Mode shape no. 43 at 31.51 Hz



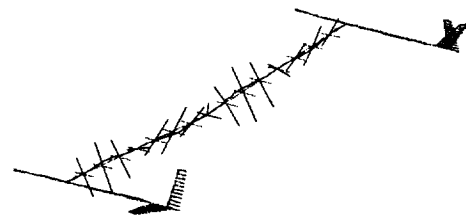
Mode shape no. 44 at 31.62 Hz



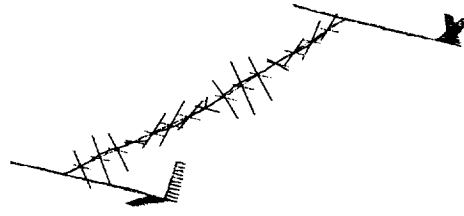
Mode shape no. 45 at 31.93 Hz



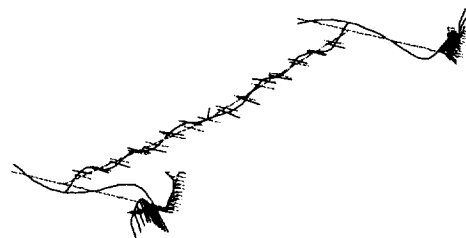
Mode shape no. 46 at 31.93 Hz



Mode shape no. 47 at 36.86 Hz



Mode shape no. 48 at 36.94 Hz

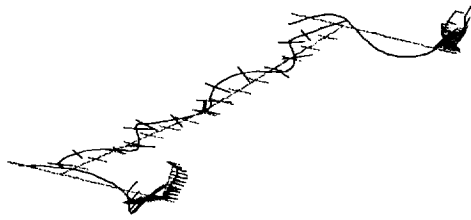


Mode shape no. 49 at 38.74 Hz

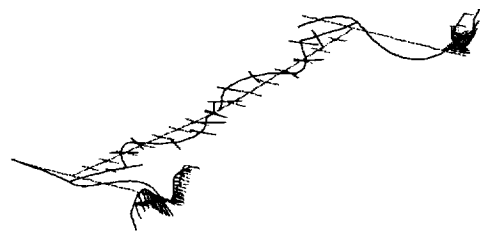


Mode shape no. 50 at 38.74 Hz

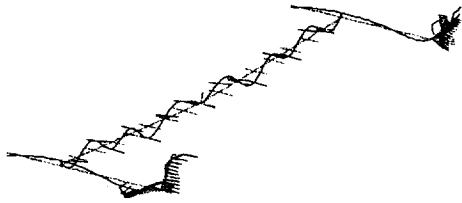
Figure 3.8: Mode shapes and natural frequencies for the two-dimensional gust analysis (continued).



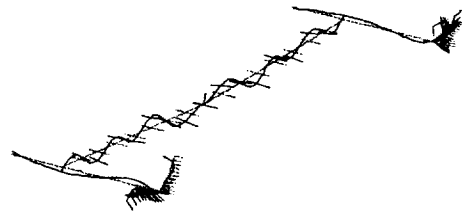
Mode shape no. 51 at 40.07 Hz



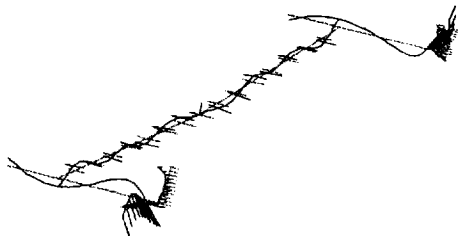
Mode shape no. 52 at 40.46 Hz



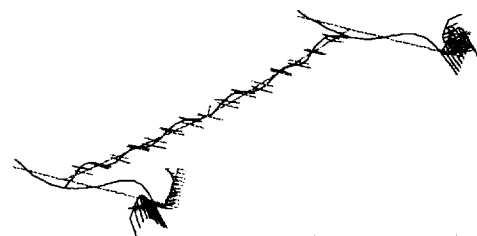
Mode shape no. 53 at 43.88 Hz



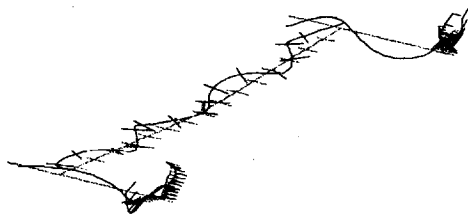
Mode shape no. 54 at 43.91 Hz



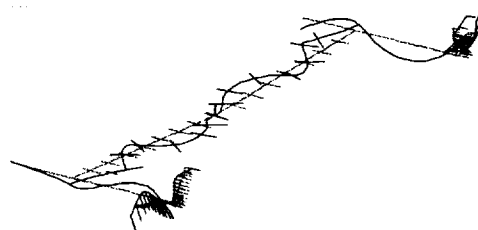
Mode shape no. 55 at 44.95 Hz



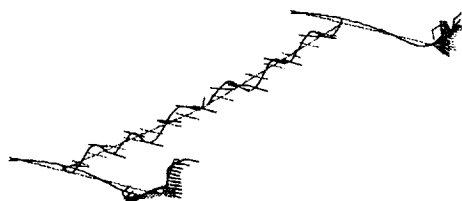
Mode shape no. 56 at 44.96 Hz



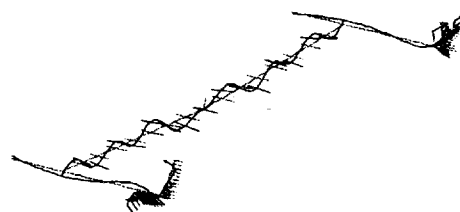
Mode shape no. 57 at 50.43 Hz



Mode shape no. 58 at 50.46 Hz

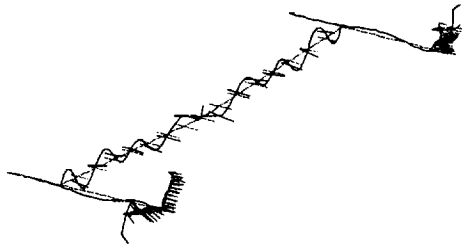


Mode shape no. 59 at 51.76 Hz

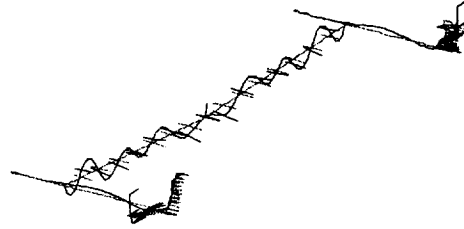


Mode shape no. 60 at 52.36 Hz

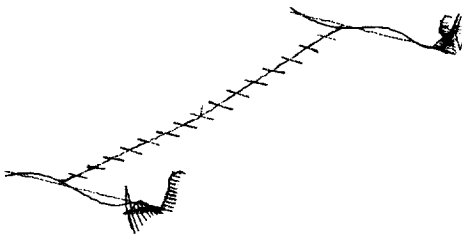
Figure 3.8: Mode shapes and natural frequencies for the two-dimensional gust analysis (continued).



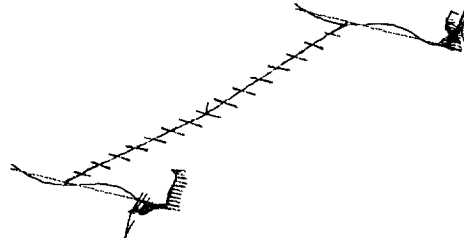
Mode shape no. 61 at 55.82 Hz



Mode shape no. 62 at 55.85 Hz



Mode shape no. 63 at 59.57 Hz



Mode shape no. 64 at 59.57 Hz

Figure 3.8: Mode shapes and natural frequencies for the two-dimensional gust analysis (concluded).

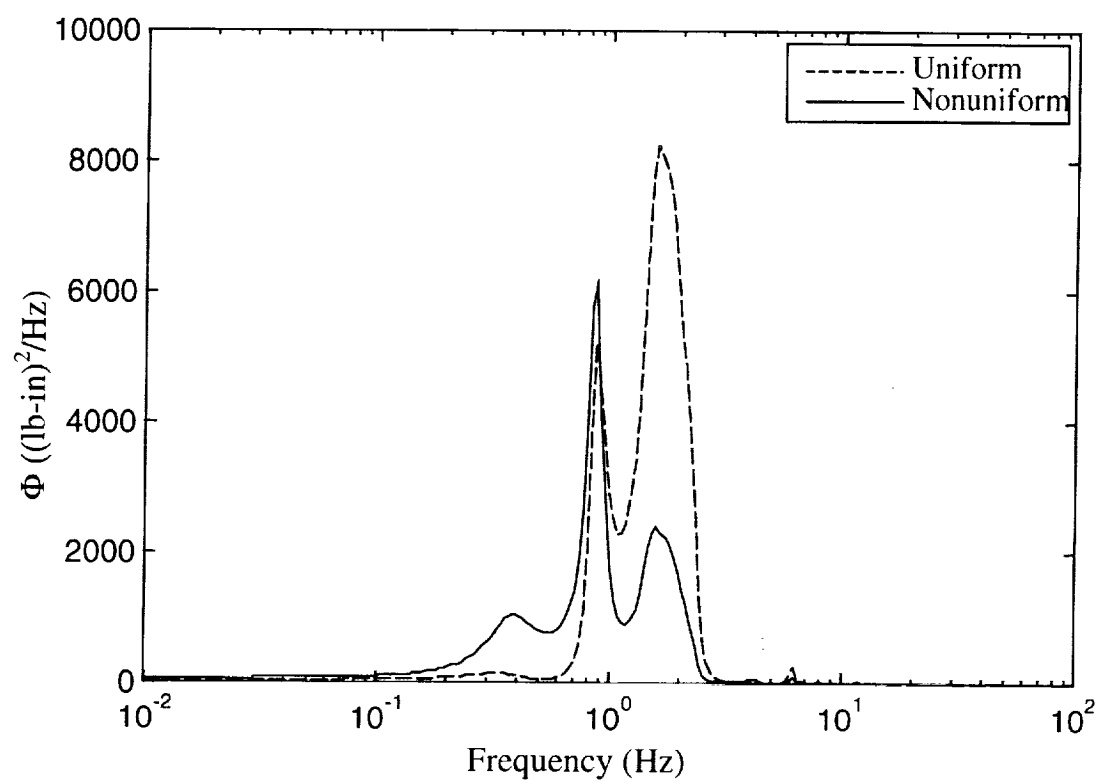


Figure 3.9: Power spectral density of M_1 at grid point 101.

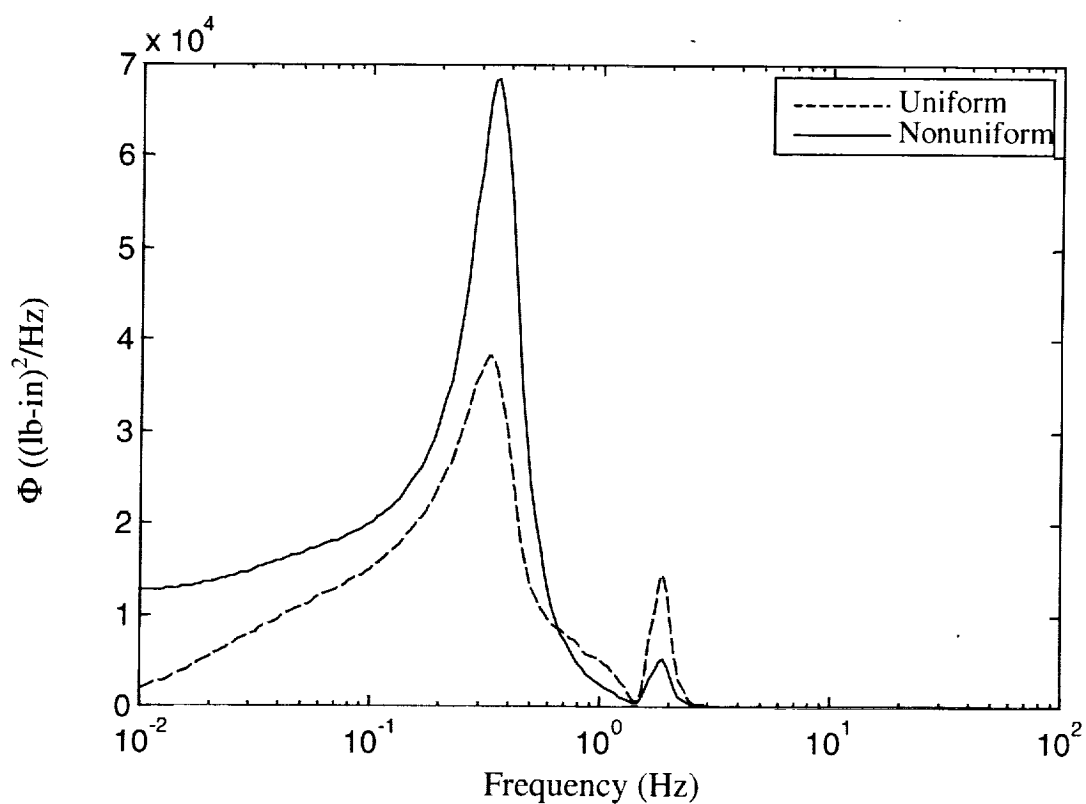


Figure 3.10: Power Spectral density of M_2 at grid point 101.

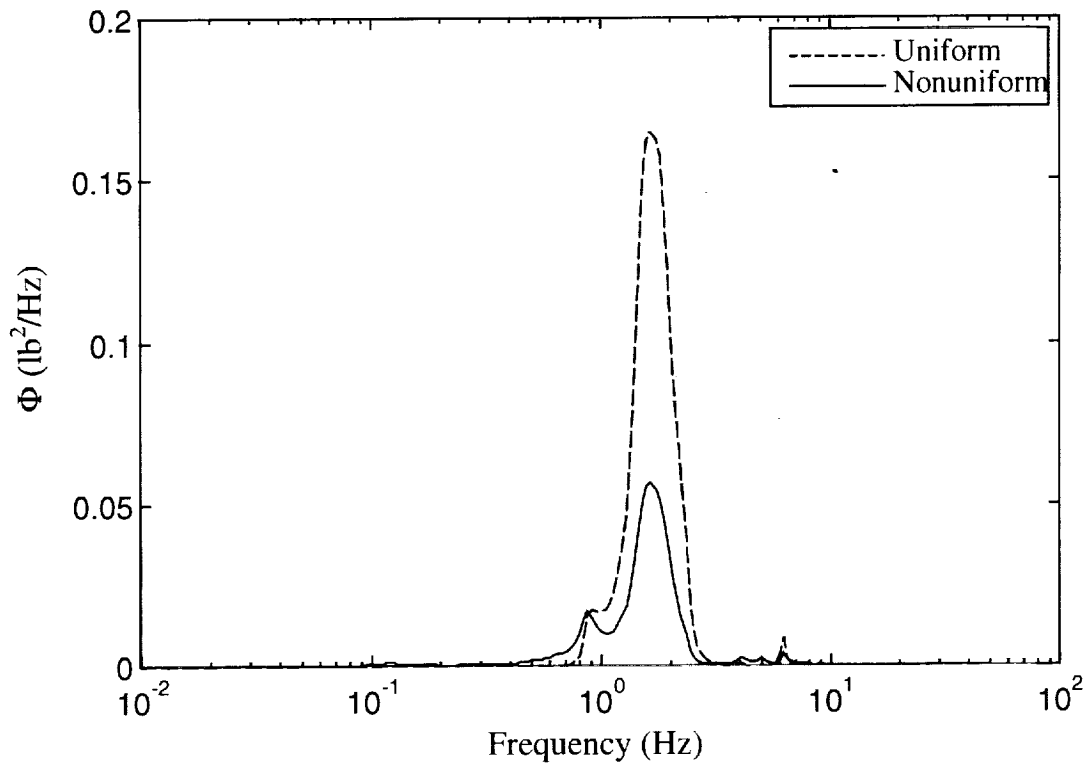


Figure 3.11: Power Spectral density of V_1 at grid point 101.

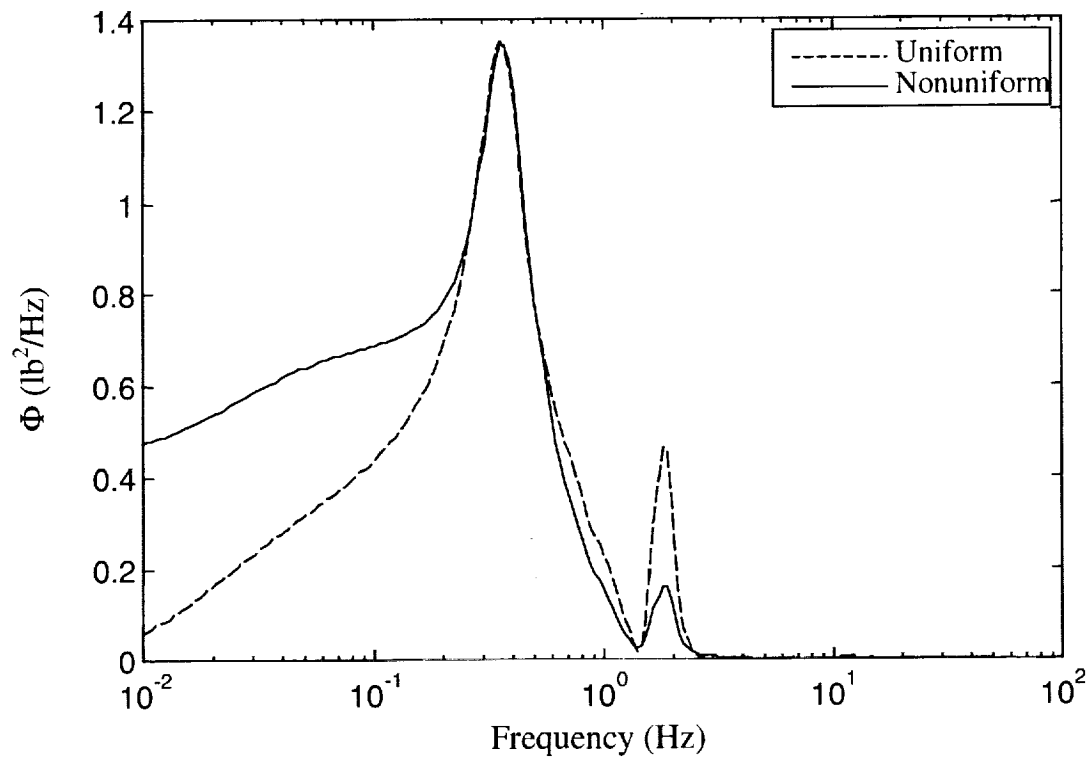


Figure 3.12: Power Spectral density of V_2 at grid point 101.

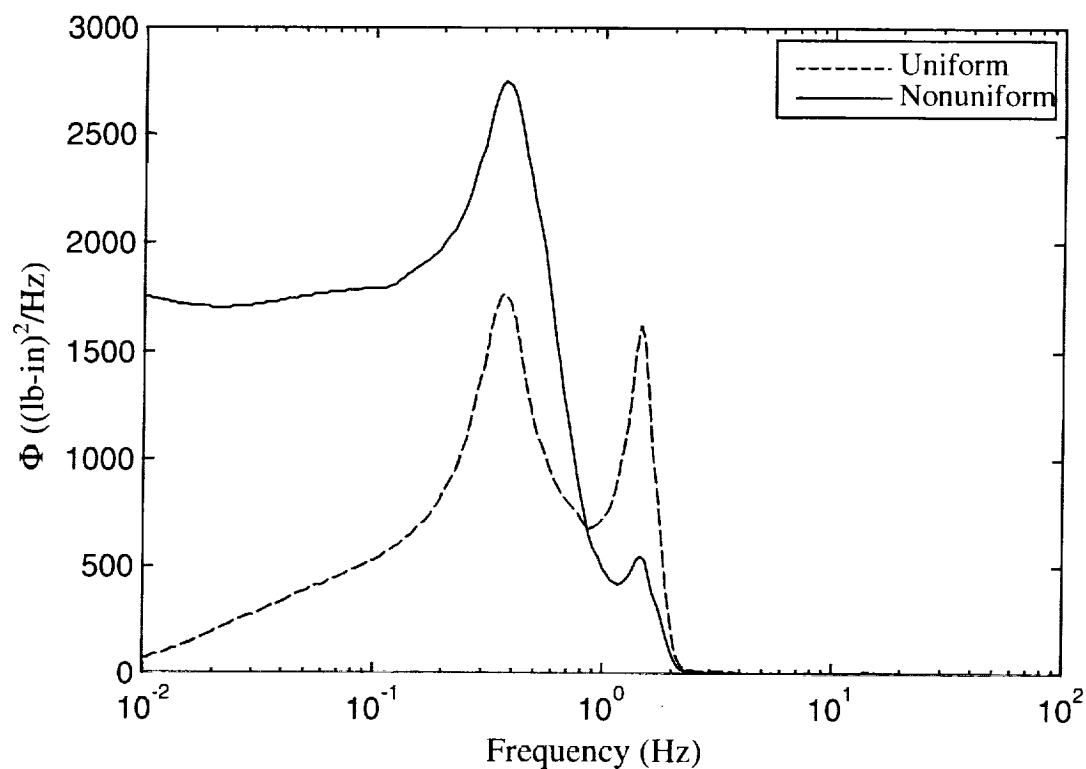


Figure 3.13: Power Spectral density of T at grid point 101.

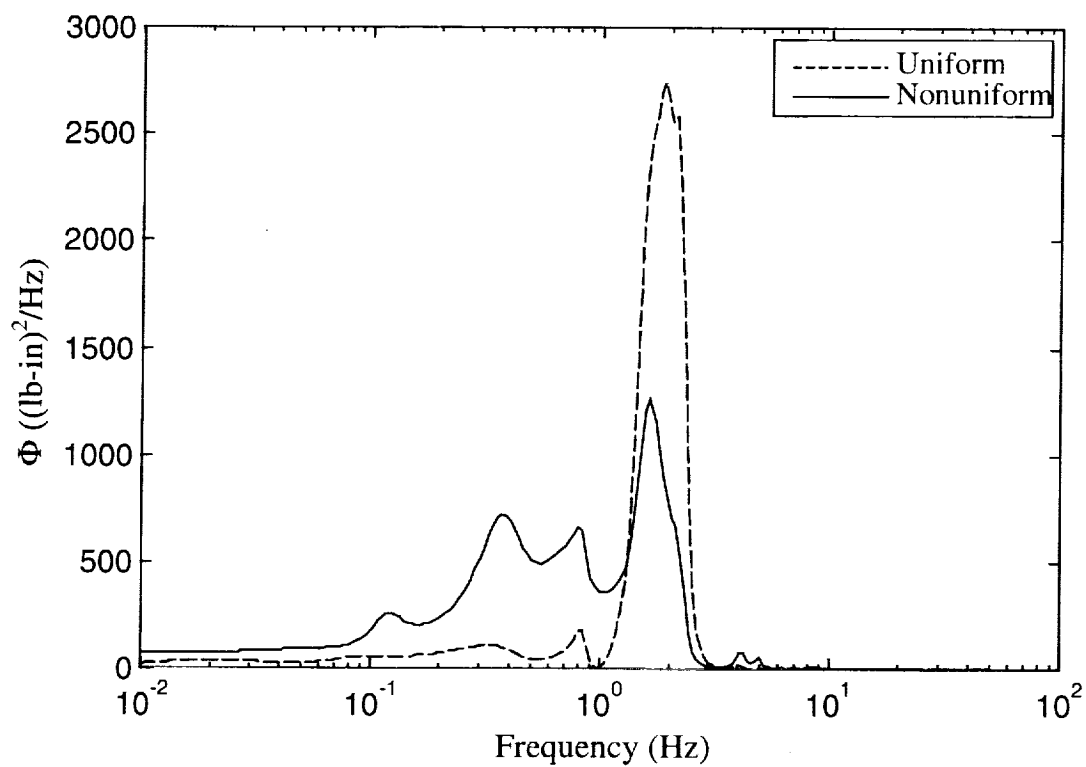


Figure 3.14: Power Spectral density of M_1 at grid point 140.

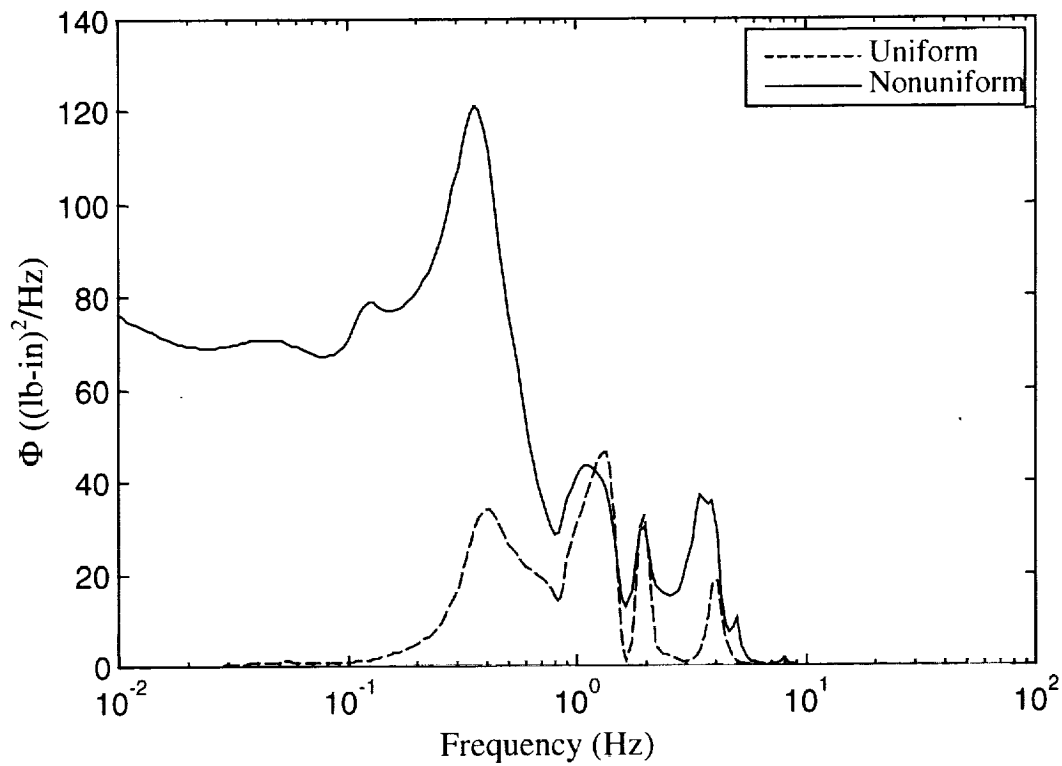


Figure 3.15: Power Spectral density of M_2 at grid point 140.

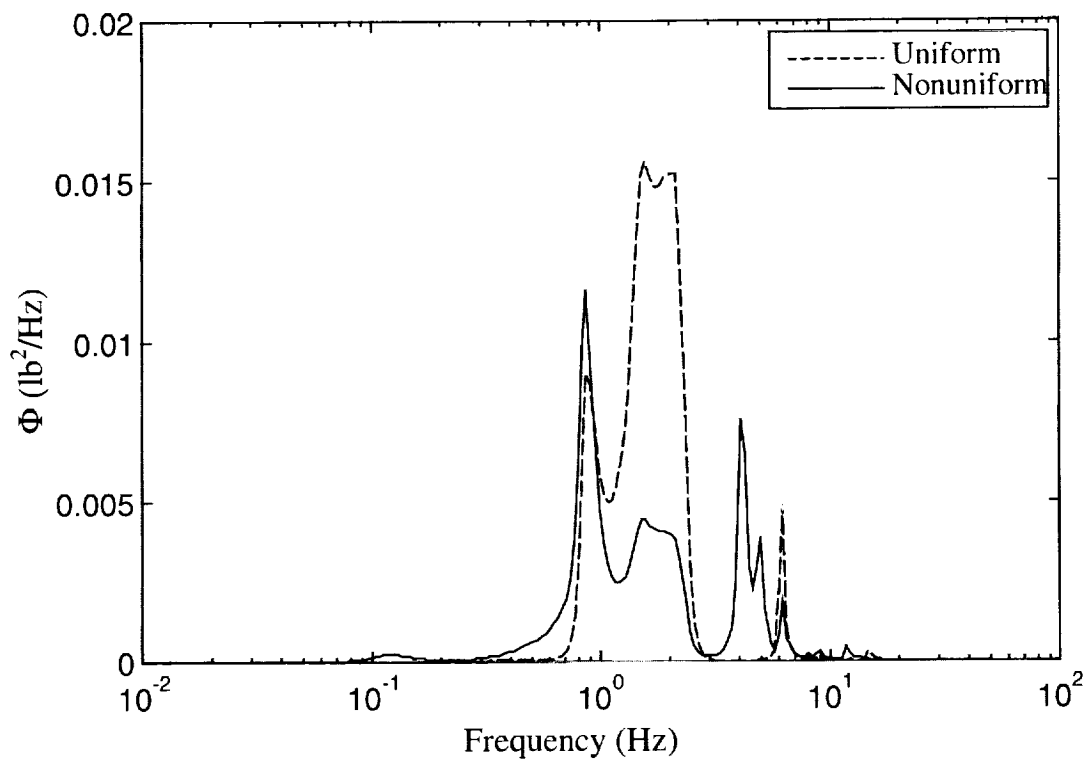


Figure 3.16: Power Spectral density of V_1 at grid point 140.

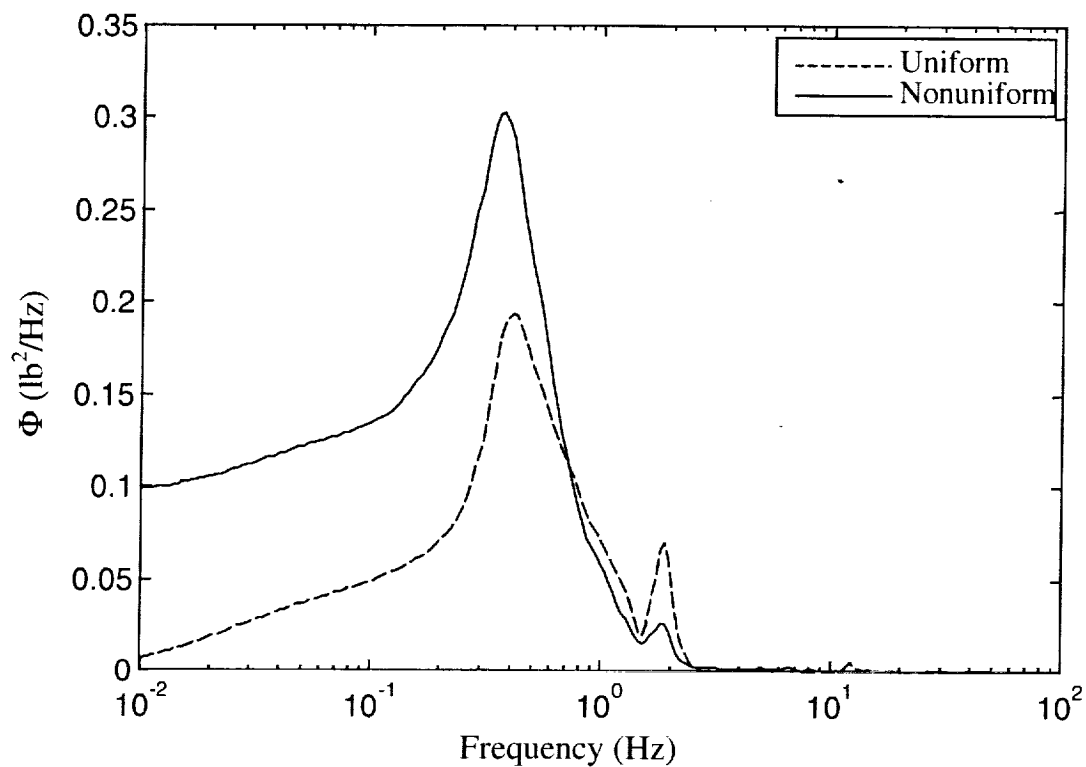


Figure 3.17: Power Spectral density of V_2 at grid point 140.

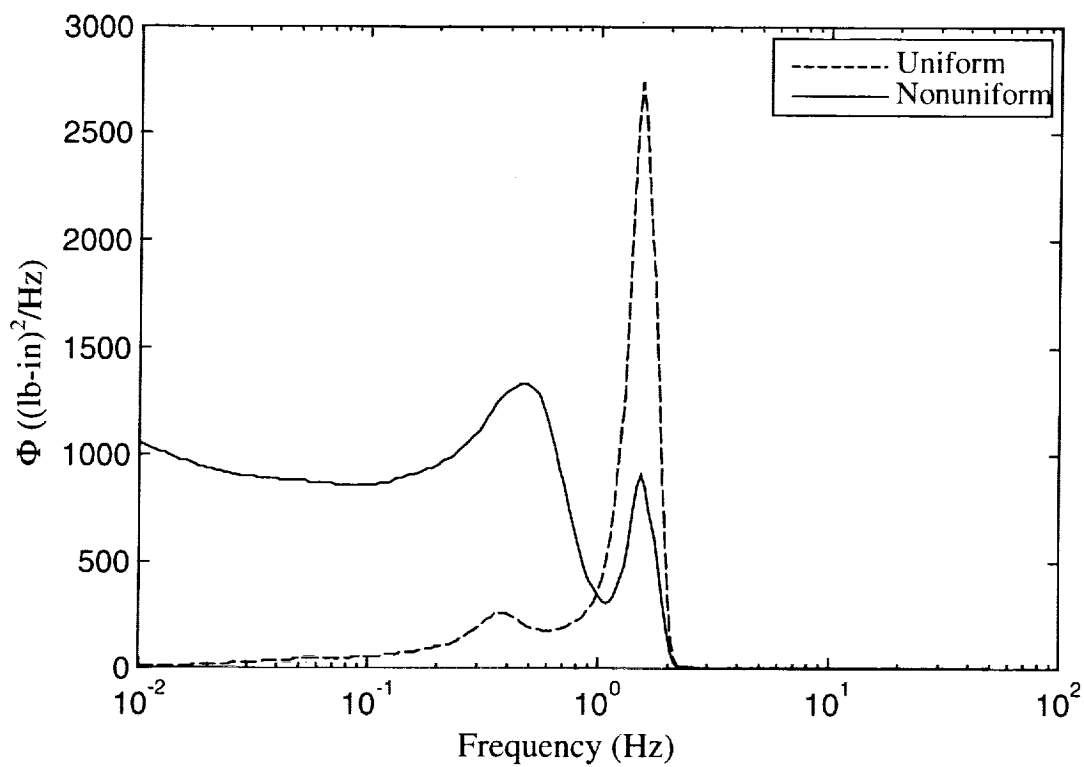


Figure 3.18: Power Spectral density of T at grid point 140.

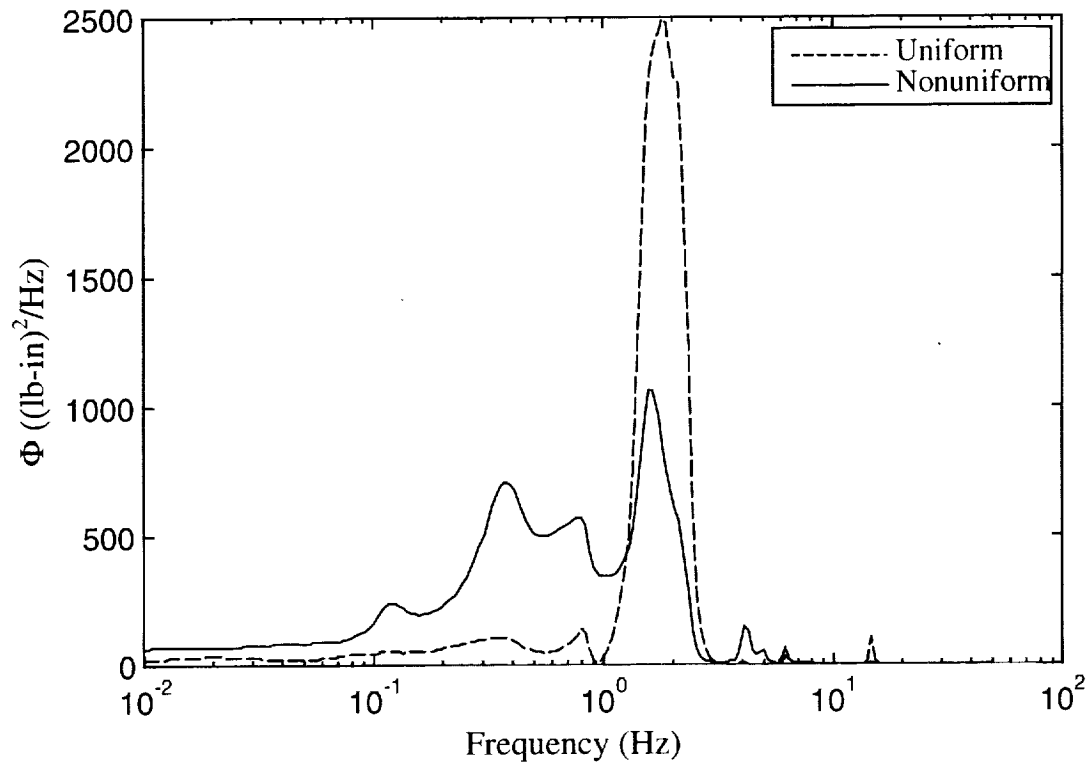


Figure 3.19: Power Spectral density of M_1 at grid point 217.

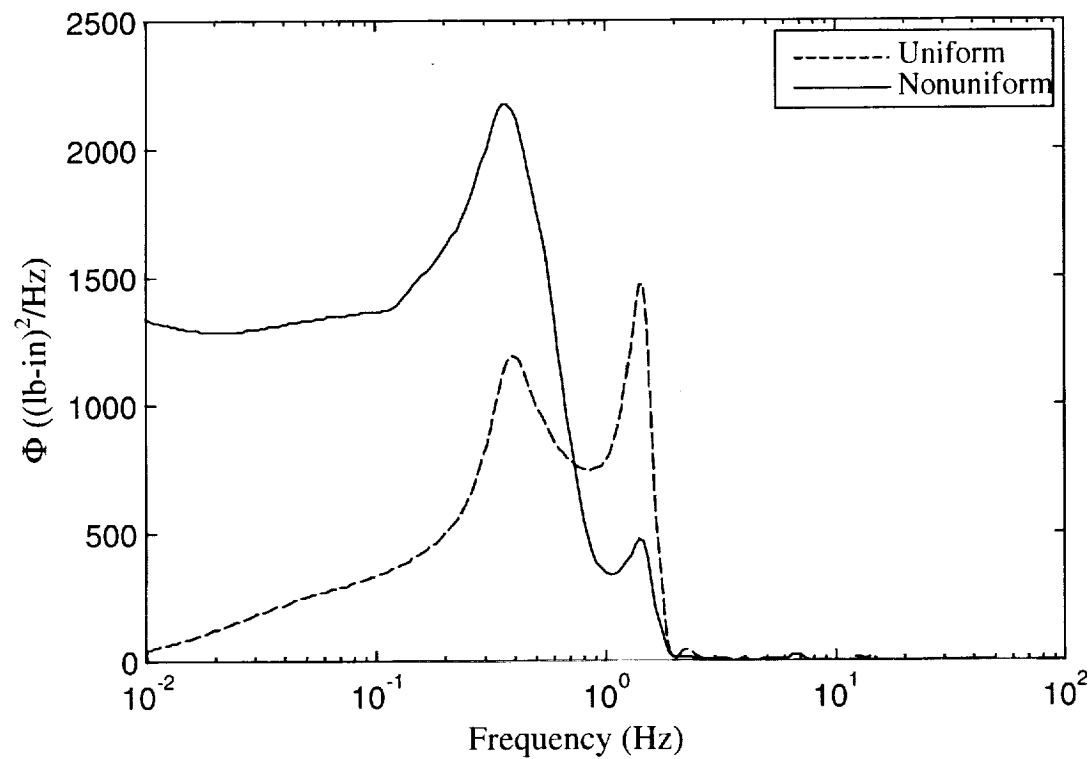


Figure 3.20: Power Spectral density of M_2 at grid point 217.

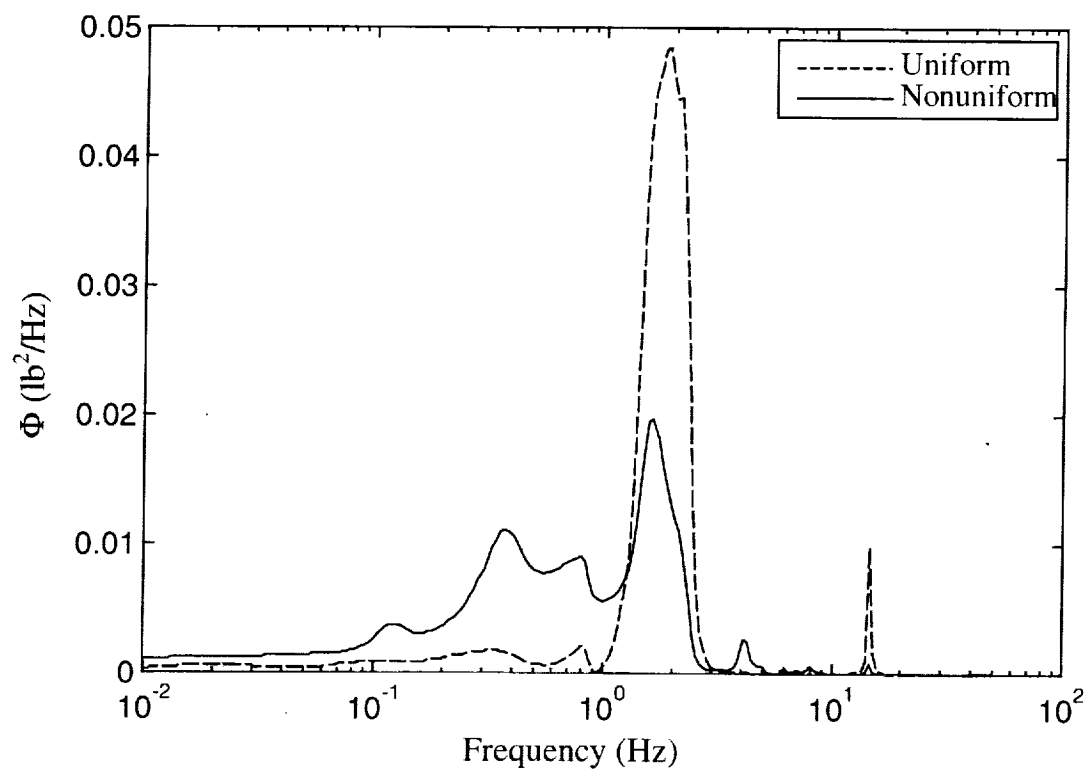


Figure 3.21: Power Spectral density of V_1 at grid point 217.

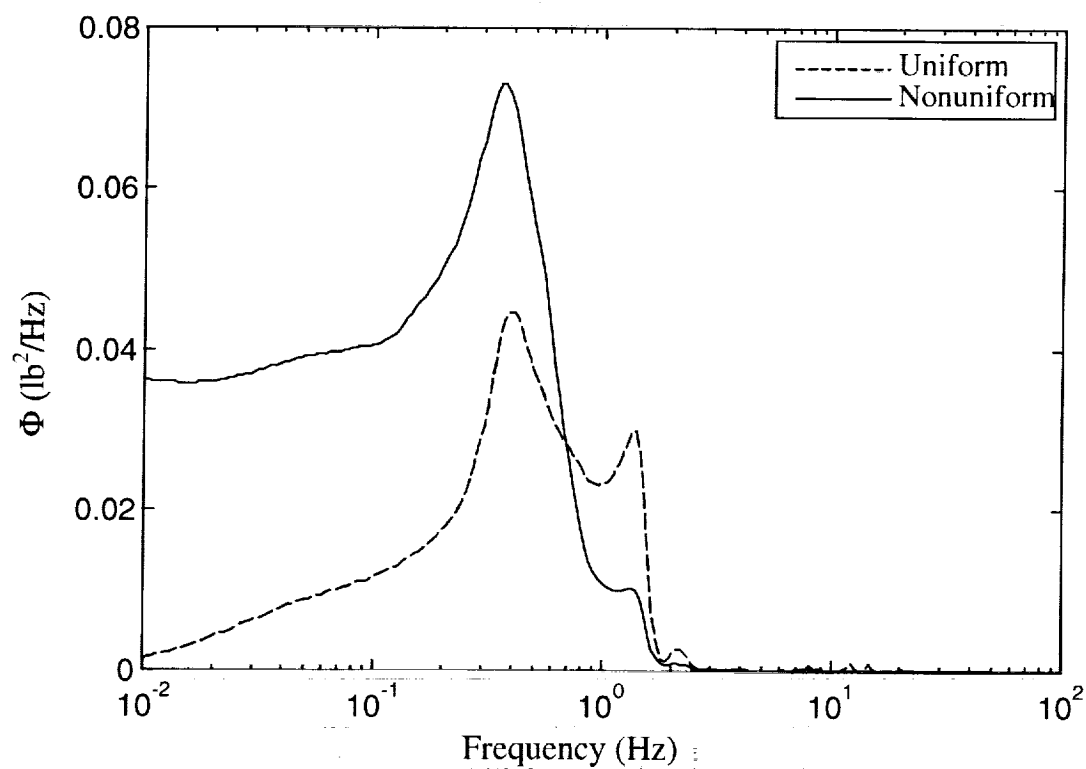


Figure 3.22: Power Spectral density of V_2 at grid point 217.

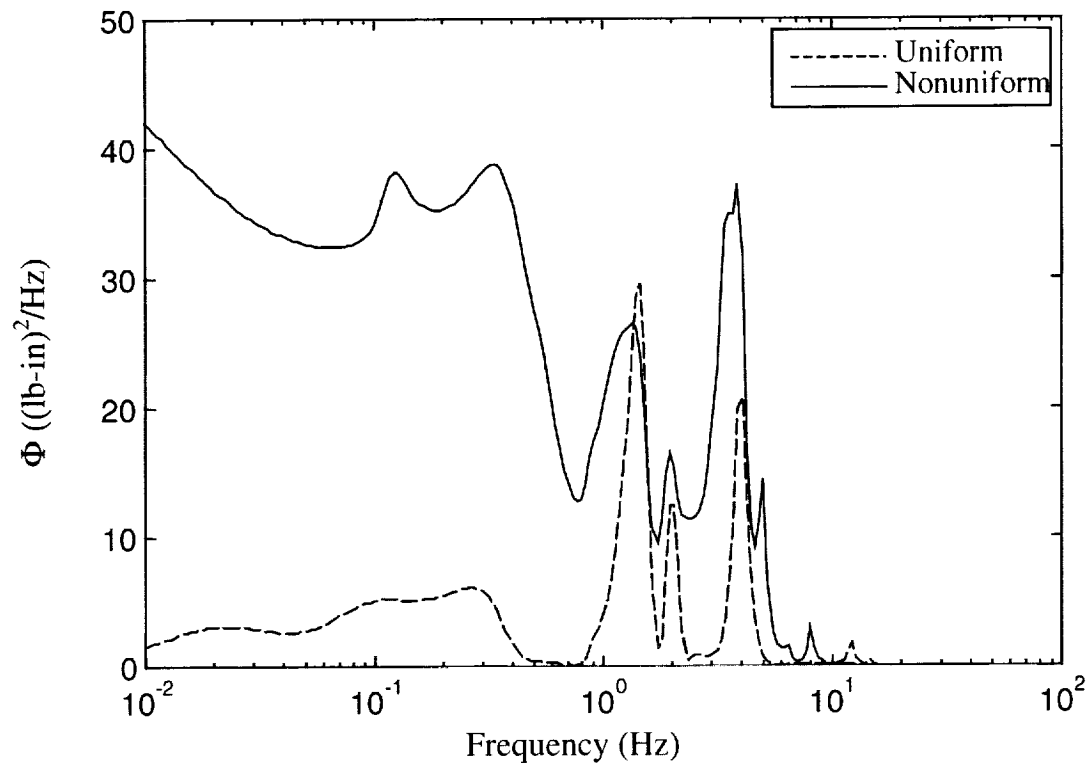


Figure 3.23: Power Spectral density of T at grid point 217.

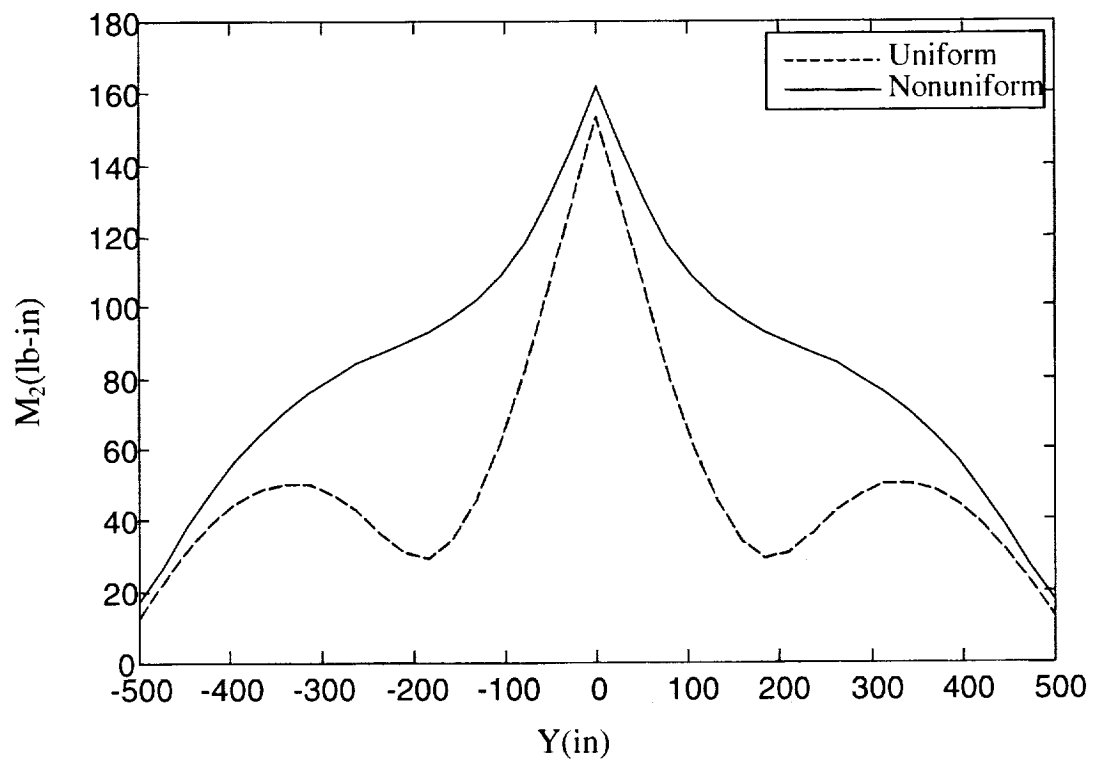


Figure 3.24: Span-wise variation of the RMS value of moment M_2 .

The PSDs of the acceleration components of the center of gravity (point 95) in the flow direction, A_1 , the vertical direction, A_3 , and about the pitching axis, A_5 , are shown in Figure 3.26-Figure 3.28, respectively. As expected, the highest acceleration magnitude is in the vertical direction. Additionally, the translational accelerations A_1 and A_3 , are affected by both bending and twisting modes. This is mainly because the center of gravity is removed from the elastic axis of the wing. The angular acceleration, A_5 , on the other hand peaks mainly at the natural frequencies of the torsion modes. Accelerations A_1 , A_2 , and A_5 for point 140 are shown in Figure 3.29-Figure 3.31, and for point 217 in Figure 3.32-Figure 3.34.

Additional output quantities were the root-mean-square value of the responses and the expected number of zero crossings with positive slope per unit time. Table 3-5 presents a comparison of these quantities for the non-uniform and uniform gusts.

In order to ascertain that the solutions were converged with respect to the frequency range analyzed and the number of modes used in the analysis, the number of modes used was increased from 50 to 64 with no significant changes in loads. This includes the response RMS values shown in Table 3-5. Also, note that in Figure 3.9-Figure 3.23, no significant loads exist above 20 Hertz in spite of the fact that flexible modes and excitation loads exist at frequencies three times greater. Another point to be addressed here is the size of the aerodynamic model. The current model has 1440 aerodynamic boxes with 160 strips. This case was also studied using a smaller model of 720 aerodynamic boxes and 80 correlation strips. The results from the smaller model were significantly different from those of the larger model, with difference in excess of 20% for some response quantities, especially in the lower frequency range.

Table 3-5: Summary of the probability parameters for response quantities.

Point number	Response	\bar{A}		N_0 (Hz)	
		Non uniform	Uniform	Non uniform	Uniform
101	M_1	61.918 lb-in	92.823 lb-in	2.1117	1.9112
	M_2	161.66 lb-in	153.57 lb-in	0.9794	1.4782
	V_1	0.2324 lb	0.3745 lb	2.8910	2.3761
	V_2	0.8749 lb	0.9530 lb	1.5689	2.2180
	T	45.284 lb-in	44.291 lb-in	1.0717	2.2135
140	M_1	39.964 lb-in	51.174 lb-in	2.1109	1.9871
	M_2	12.805 lb-in	8.0928 lb-in	2.5697	2.4661
	V_1	0.1263 lb	0.1475 lb	4.8235	4.0010
	V_2	0.4477 lb	0.4190 lb	1.9287	3.2141
	T	38.245 lb-in	41.039 lb-in	1.1334	1.9075
217	M_1	38.491 lb-in	50.282 lb-in	2.4539	3.4127
	M_2	40.182 lb-in	40.108 lb-in	1.6933	2.7075
	V_1	0.1660 lb	0.2351 lb	3.6163	6.0001
	V_2	0.2200 lb	0.2150 lb	2.1295	3.3317
	T	10.645 lb-in	6.1148 lb-in	3.3283	4.6871

Where, \bar{A} = Root Mean Square value of the response.

N_0 = Expected number of zero crossings with positive slope per unit time

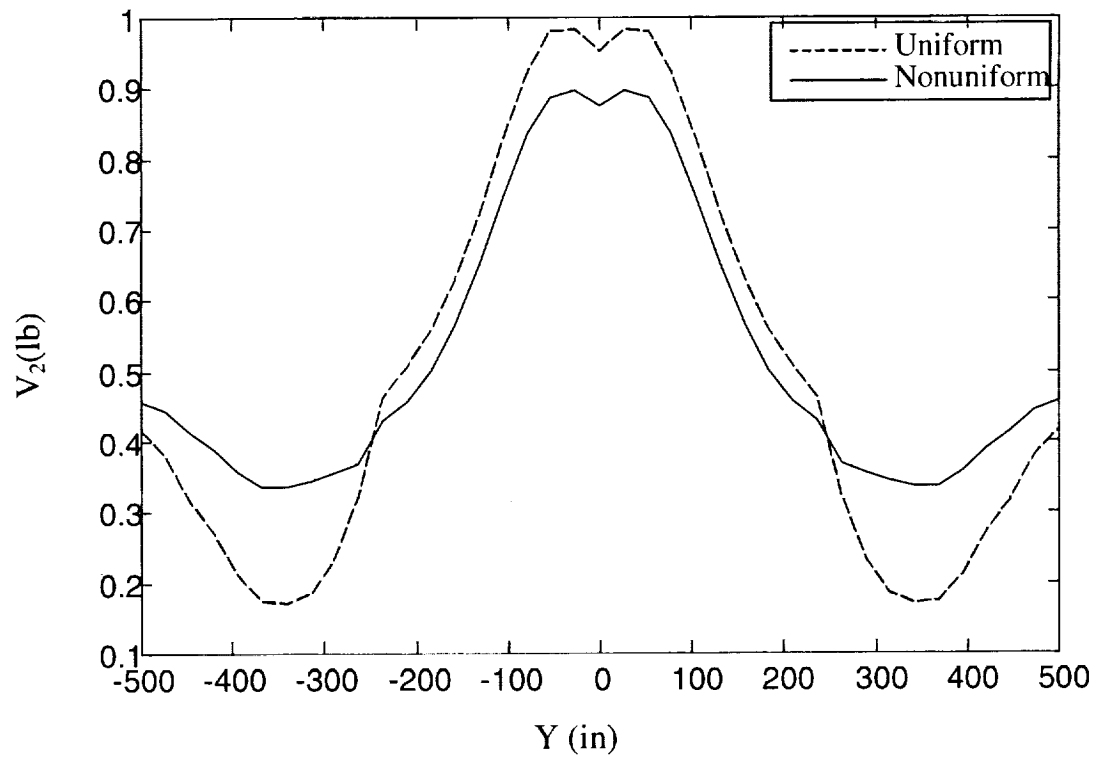


Figure 3.25: Span-wise variation of the RMS value of shear force V_2 .

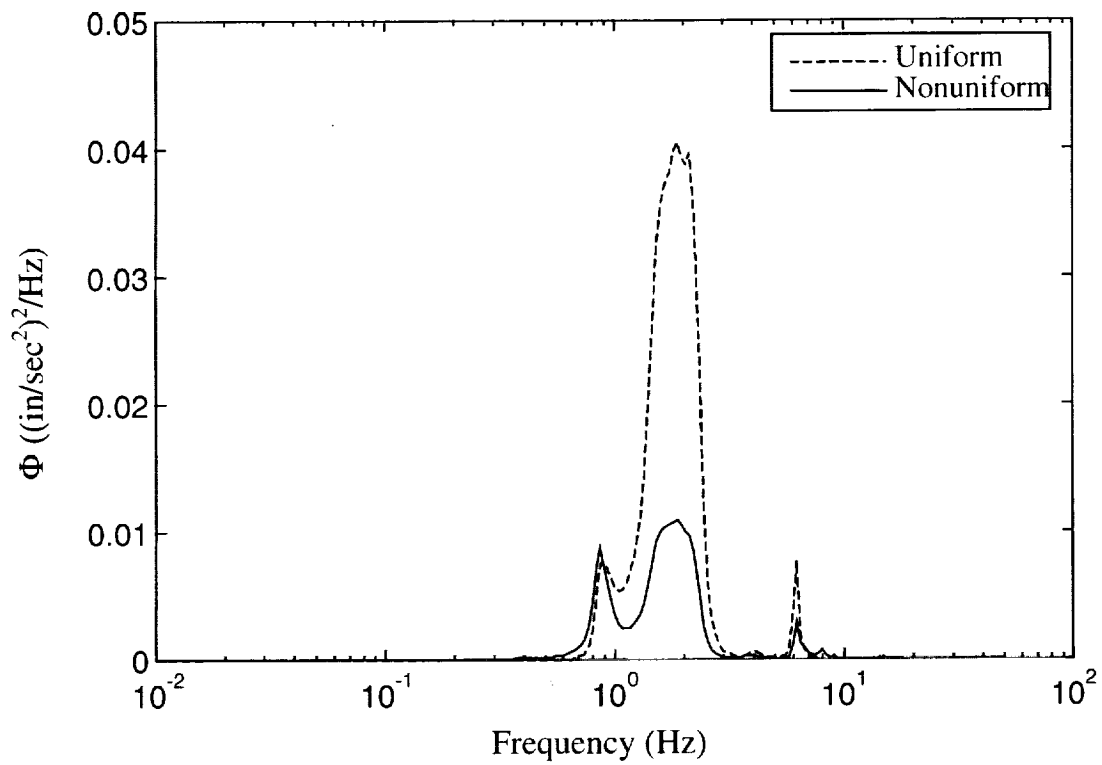


Figure 3.26: Power spectral density of the acceleration A_1 for the center of gravity.

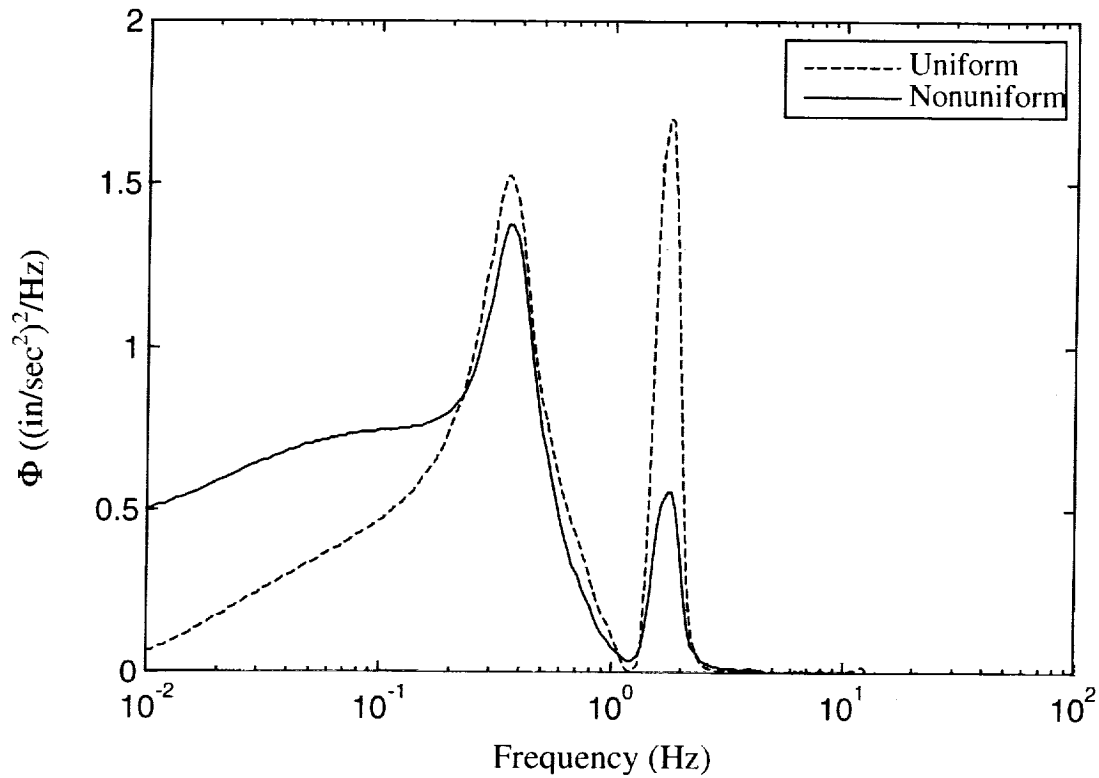


Figure 3.27: Power spectral density of the acceleration A_2 for the center of gravity.

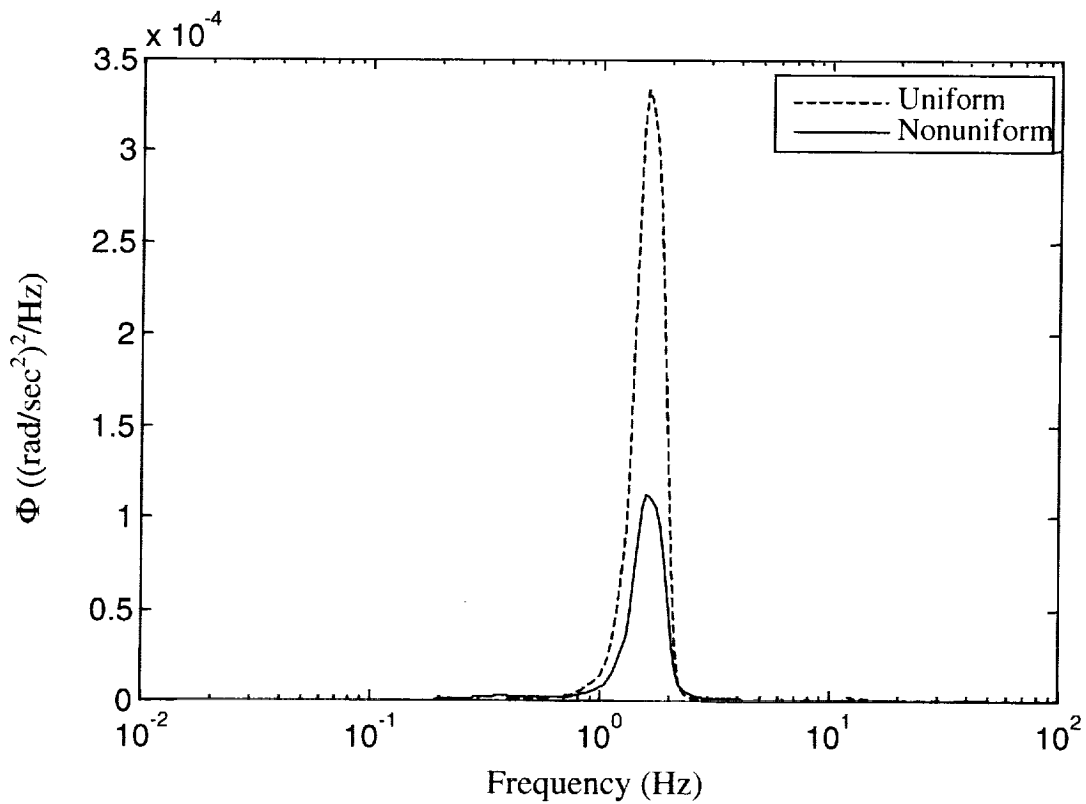


Figure 3.28: Power spectral density of the angular acceleration A_5 of the center of gravity.

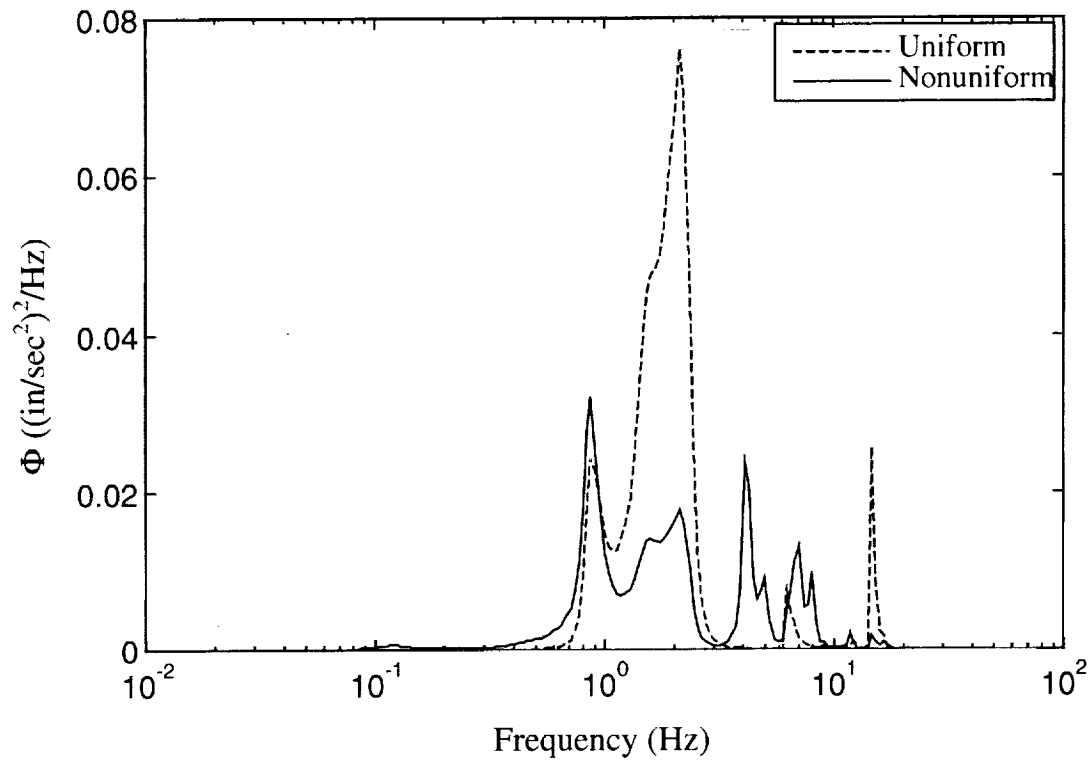


Figure 3.29: Power spectral density of the acceleration A_1 for grid point 140.

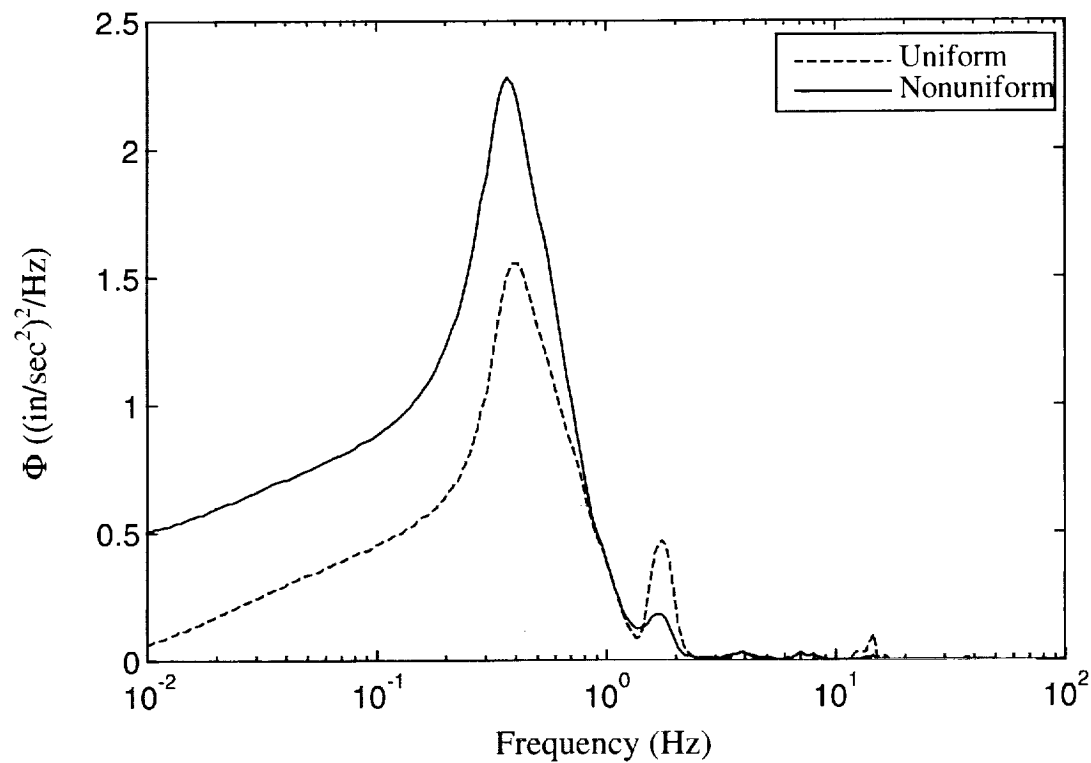


Figure 3.30: Power spectral density of the acceleration A_3 for grid point 140.

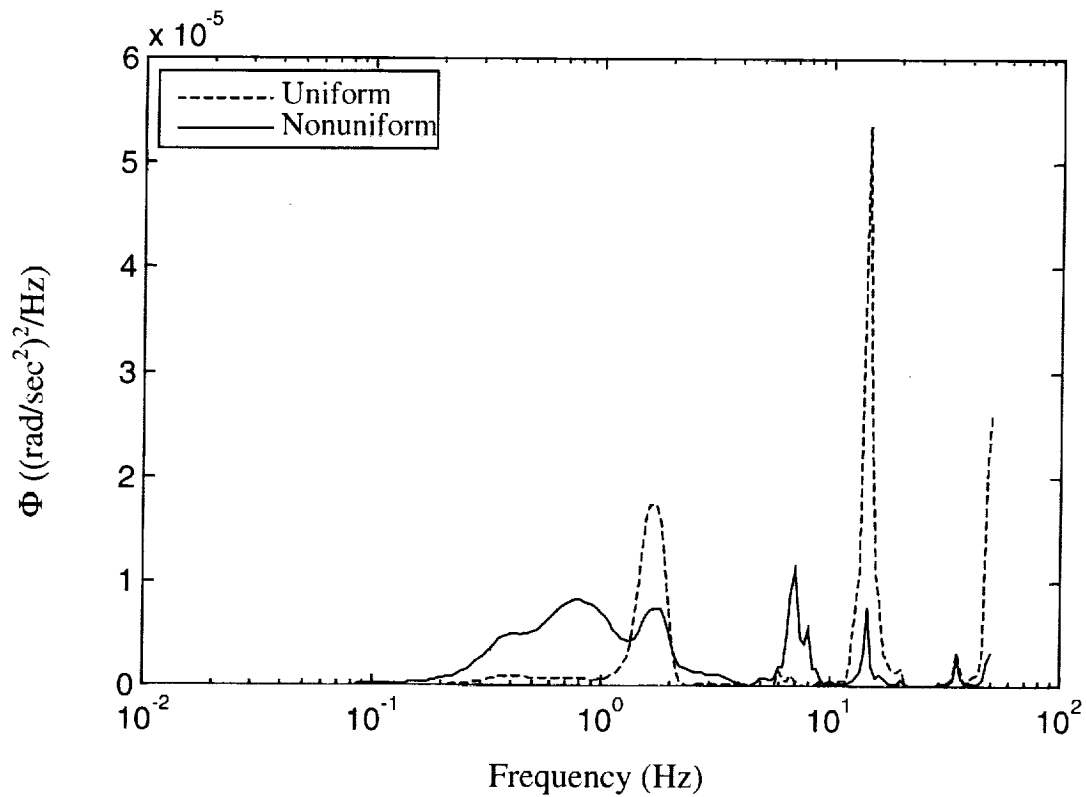


Figure 3.31: Power spectral density of the angular acceleration A_5 for grid point 140.

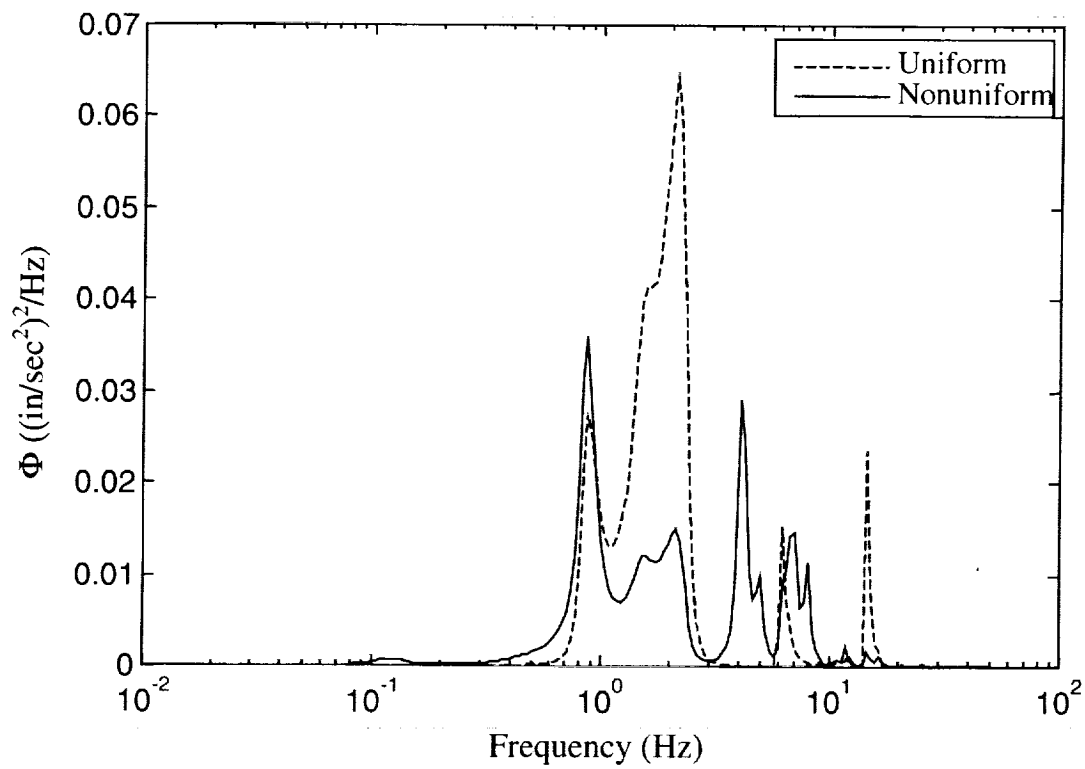


Figure 3.32: Power spectral density of the acceleration A_1 for grid point 217.

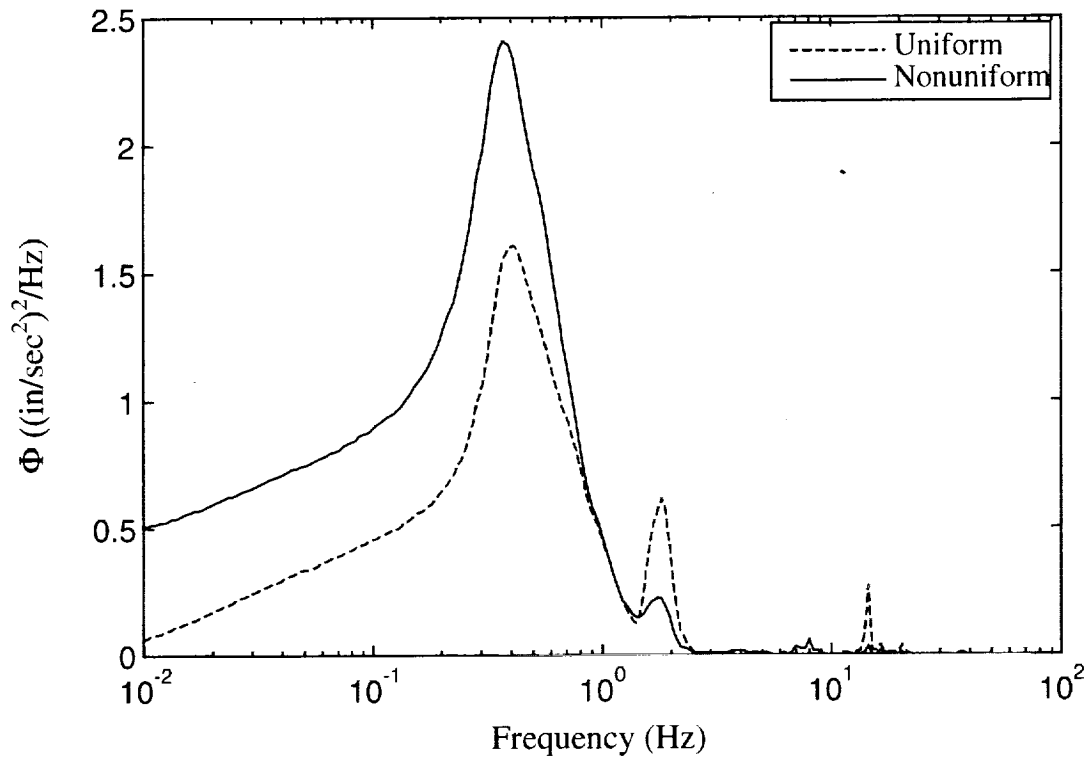


Figure 3.33: Power spectral density of the acceleration A_3 for grid point 217.

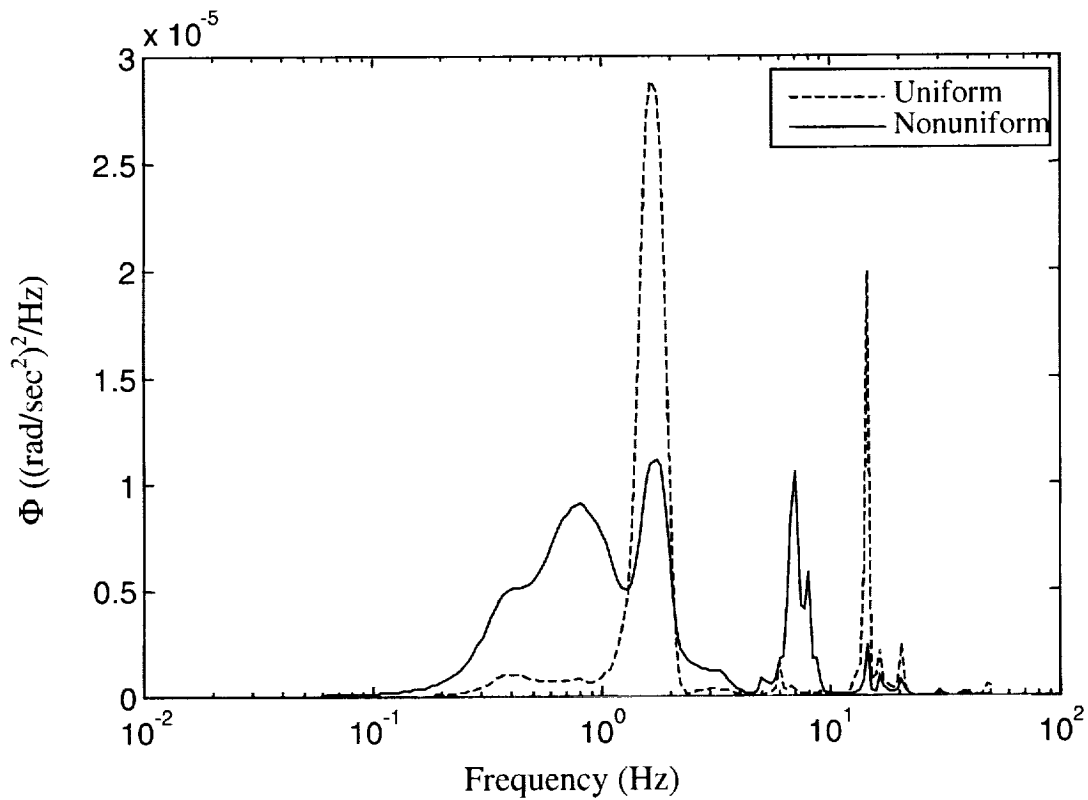


Figure 3.34: Power spectral density of the angular acceleration A_5 for grid point 21.

4 DISCRETE GUST ANALYSIS

4.1 Introduction

In this chapter we perform a tuned discrete gust analysis on the semi-span Alliance 1 aeroelastic/finite element model using MSC/NASTRAN's Discrete Gust Response Analysis (Reference 2) capability. The tuned discrete gust analysis presented here is based on the current (year 2000) analysis requirements of the Federal Aviation Administration Regulation (Part 25.341) airworthiness standards for transport airplanes. Due to the nature of the aircraft analyzed however, the family of gust gradient lengths used differs from that prescribed for transport aircraft.

The FAA standards have changed over last few years. In the past, a single discrete gust analysis was conducted with a gust gradient length of

$$H=12.5\bar{c} \quad (4.1)$$

where \bar{c} is the mean aerodynamic chord, and only from that analysis where the peak loads and the correlated loads assessed. Because the single calculation did not give the maximum design load, a tuned discrete gust approach was adopted. The new requirement has two alleviating factors included in load computations. The first is for high altitude aircraft that spend little time at gust-prone low altitudes and the other is a $H^{1/6}$ factor which has an attenuating effect on the higher frequency modes.

Wing loading for the Alliance 1 is approximately 5 lbs/ft², which is less than 1/20th of a typical transport aircraft. Typical internal structural loads due to discrete gusts for this type of light aircraft tend to be much less than for commercial transports because the mass is more evenly distributed along the wing span and they are lifted or plunged vertically during uniform discrete gust encounters with little inertia resistance. Conversely, accelerations in response to discrete gusts tend to be larger than for heavier transports.

Table 4-1: Rigid body and flexible natural frequencies of all modes used in Discrete Gust Response Analysis.

Mode no.	Frequency hertz	Mode no.	Frequency hertz	Mode no.	Frequency hertz	Mode no.	Frequency hertz
1	0	9	4.117058	17	15.33962	25	38.73983
2	0	10	6.115234	18	16.71737	26	40.05799
3	0	11	6.749472	19	21.31522	27	43.87366
4	0.380363	12	8.314463	20	23.91713	28	44.94824
5	0.8129176	13	9.271044	21	26.45134	29	50.46395
6	1.289616	14	10.87025	22	31.49955	30	51.7564
7	2.036124	15	12.84028	23	31.92673	31	55.83799
8	2.201072	16	14.59939	24	36.93553	32	59.57046

The basic model for this analysis is the same semi-span finite element model described in Section 2. The model was structurally constrained to reflect symmetrical motions at the aircraft's centerline. The lowest frequency 32 modes, including three rigid-body modes and 29 flexible modes up to 60 Hertz, were used and are listed in Table 4-1. Mode shapes can be viewed in plots presented in Figure 2.3. The doublet-lattice method was used to compute the unsteady aerodynamics and the box layout used is also the same as in reference Section 1.

The parameters for the single flight condition used in the analysis are listed in Table 4-2. The fuel load, vehicle weight, and pitch inertia conditions specified in the Table are for the full-span aircraft. The weight and pitch inertia was computed from the finite element model. The gust velocity used in the analysis was taken from Reference 1. Some of the dimensions of the Alliance 1 vehicle are given in Table 4-3 and are for the full-span vehicle. The MSC/NASTRAN input file used for the discrete gust response analysis is listed in Appendix H. This file contains the structural and mass element definitions for the half-span finite element model. Since it is an aeroelastic model, the file listing also provides the geometry definitions for doublet lattice unsteady aerodynamics. Because the analysis requires a Fourier transform method to compute time response of the loads and accelerations, the frequency increment and time steps are listed in the Appendix in the FREQ and TSTEP entries. The discrete gust loading is rather complicated, requiring multiple TLOAD2 entries to build a particular excitation waveform for each gust gradient analysis. The TLOAD2 entry is a fairly general waveform generator, but for the purposes of this analysis, it provides unit steps and cosine waveforms. To generate one gust excitation load, multiple TLOAD2 entries are combined with a DLOAD entry to form a 1/2 -cosine/2 waveform shape. To reduce the number of input files, several TLOAD2 and DLOAD sets are listed. Each set represents a different gradient gust case. All the different gradient gust lengths cases are necessary to complete the tuned discrete gust analysis.

Table 4-2: Vehicle flight condition and inertial characteristics.

Altitude	1000.0 ft.
True Air Speed	98.3 ft/sec
Dynamic Pressure	.077444 psi
Mach Number	0.09
Gust Velocity, U_{dc}	36.7 ft./sec.
Vehicle Flight Weight	2095.478 lbs.
Pitch Inertia	109,779.4 lbs-ft ²
Fuel Weight	333.9 lbs.

Table 4-3: Vehicle dimensions, areas and ratios.

Wing Reference Area	439 ft. ²
Wing Span	87.6 ft.
Length	34.4 ft.
Reference chord, \bar{c}	4.25 ft.
Aspect Ratio	24.3
Root Chord	5 ft.
Tip Chord	3.48 ft.

4.2 Analysis Procedure

The discrete gust analysis used in SC/NASTRAN is summarized in Figure 4.1, which shows two input paths to generate the gust load time response. The top path generates the prescribed 1-cosine excitation waveform with a peak gust velocity of U_{dc} . The gust velocity waveform is attenuated by the $H^{1/6}$ factor and converted to a gust angle of attack when it is divided by the vehicle's forward velocity. F_g has a computed value of nearly one having no effect on this analysis. The final step of the top path is the Fourier transform of the excitation time response into the frequency domain to form an excitation

frequency response function. In the bottom path, the frequency domain equations of motion representing the aeroelastic states and the gust penetration aerodynamics and structural load output coefficients are combined to form the frequency response functions of load output to an arbitrary gust input. Before the unsteady aerodynamics in the aeroelastic equations of motion can be used in the gust analysis, they must first be converted to functions of the real frequencies instead of reduced frequencies. Then the aerodynamics must be interpolated to the gust analysis frequency points (these are the input frequency points listed by FREQ entry). The two paths are combined to form a final product that is a function of frequency. The final product is the load frequency response to the 1-cosine excitation. Each of the load frequency response functions is inverse Fourier transformed to obtain the time history responses of the loads.

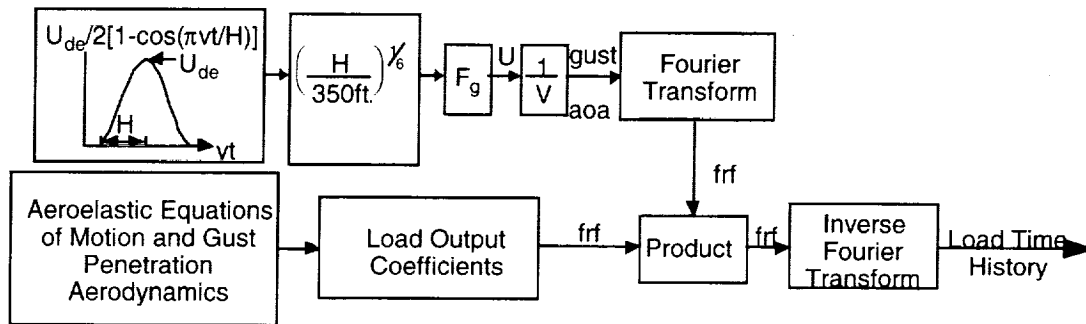


Figure 4.1: Analysis flow in MSC/NASTRAN for discrete gust response computations.

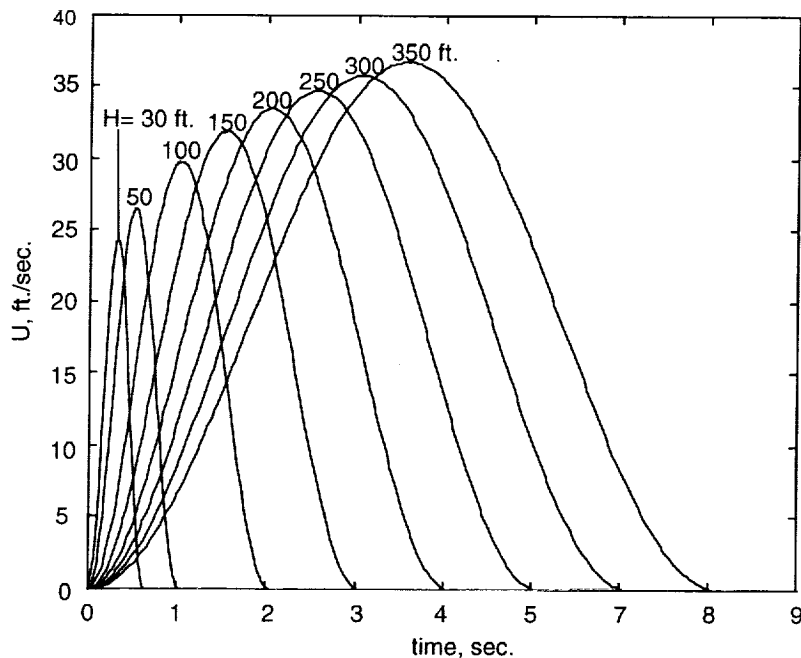


Figure 4.2: The 1 - cosine discrete gust velocities at various gradient lengths.

Since the MSC/NASTRAN Discrete Gust Response Analysis currently does not have subcase capability to analyze all the different gust gradient lengths for one tuned discrete gust analysis run, it is necessary to run one analysis for each gust gradient length. The velocity waveform plots shown in Figure 4.2 are the velocities computed at point U in the top path of Figure 4.1. The set shown is provided as an example and

is not the one used for this study, but it does show a typical set that would be used to complete a tuned discrete gust analysis of a transport. In order to investigate the maximum structural responses in a light-weight vehicle like the Alliance 1, a special set of gradient lengths was selected which included shorter lengths than for a transport.

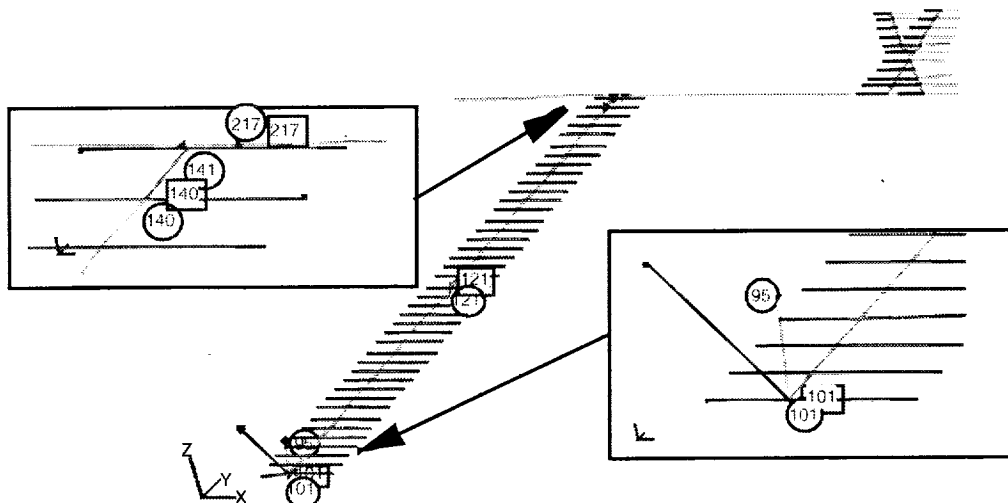


Figure 4.3: Element and node response locations on the half span finite element model of Alliance 1 aircraft.

4.3 Discrete Gust Response Analysis Output Quantities and Locations

For gust load certification purposes, loads and accelerations at many thousands of locations are typically output from a discrete gust response analysis to find the points where critical load conditions can occur on the aircraft. For purposes of this analysis, five points were selected for outputting load and acceleration time history responses. These locations are shown in Figure 4.3 and can be distinguished as nodes or element locations by circles or rectangles around their respective node or element numbers. Many of the locations output both nodal accelerations and element forces. The five location are: node 95 at the CG., node 101 at the centerline and element 101 at wing root, element and node 121 at mid span, element and node 140 at the wing tip, and element and node 217 on the boom just aft of the wing elastic axis. At each of the node locations, in-plane, vertical, and local pitch accelerations are output by MC/NASTRAN. For each bar element location, MSC/NASTRAN outputs in-plane and vertical shear forces, bending moments and torsion moments.

4.4 Results and Discussion

Although all the results mentioned above are generated by the MSC/NASTRAN deck in Appendix H, only a selection of the results will be presented in the this report. The wing root location had the largest gust loads. Figures 4.4-4.6 show both the vertical and in-plane components of load. For this location, nearly all the load time responses are shown.

Traditionally, vertical bending moment, vertical shear force, and torsion moment along the wing are computed, since the force created by the gust acts in the vertical direction. The in-plane loads generally are much smaller and regarded as being inconsequential. In this aircraft design, where the wing has a high aspect ratio and the spar consists of round-tube composite construction, the in-plane components of loads are smaller but not inconsequential as compared to the vertical component. In the figures, all the

gust gradient lengths load responses are given as a family of curves. Only one gradient length gives the maximum (or minimum) load for each family of load plots. Table 4-4 lists the gradient lengths used in this tuned gust study and also their respective frequencies. Figure 4.7-Figure 4.9 show a family of the vertical acceleration response curves at the vehicle's wing root, wing mid span, and wing tip locations respectively.

Table 4-4: Gust gradient lengths and corresponding frequencies used in the tuned gust analysis.

H, ft.	f, hz	H, ft.	f, hz	H, ft.	f, hz
6.64	7.4	39.8	1.23	85.0	.578
13.3	3.7	46.5	1.06	106.	.463
19.9	2.47	53.1	.925	142.	.346
26.6	1.85	60.7	.809	212.	.231
33.2	1.48	70.8	.694	425.	.116

It is interesting to note that the acceleration responses are the largest at mid-span, but if we look at the vehicle in terms of its mass distribution, of the three output locations, mid-span has the least mass. This is expected because the lightest mass areas usually respond with the highest accelerations.

Generally, the response points of highest magnitude are of interest. Figure 4.10-Figure 4.13 show the maximum load and the absolute value of the minimum load for each of the gradient lengths at a given location.

An interesting aspect of this tuned gust analysis is that for all the locations and load types examined, gust gradient lengths of less than 30 feet were needed in order to find the maximum absolute responses. The necessity of using these shorter gradient lengths is significant, since the Federal Aviation Administration Regulation Part 25.341 specifies an analysis range to be between 30 feet to 350 feet. Because the Alliance 1 is very light and exhibits very low natural frequencies, the standard analysis starting point of 30 feet gust gradient length was not low enough. Maximum and minimum accelerations are shown in Figure 4.14-Figure 4.16. The mid-wing station is shown to attain the highest vertical accelerations of 2.4 g's at a gust gradient length of 13 feet. The frequency of this gradient length is approximately 3 Hertz and it seem to interact with second and third bending modes near 2 to 4 hertz.

The second and third bending modes show little motion at the wing tip and aircraft centerline, indicating the large mass concentrations at those locations.

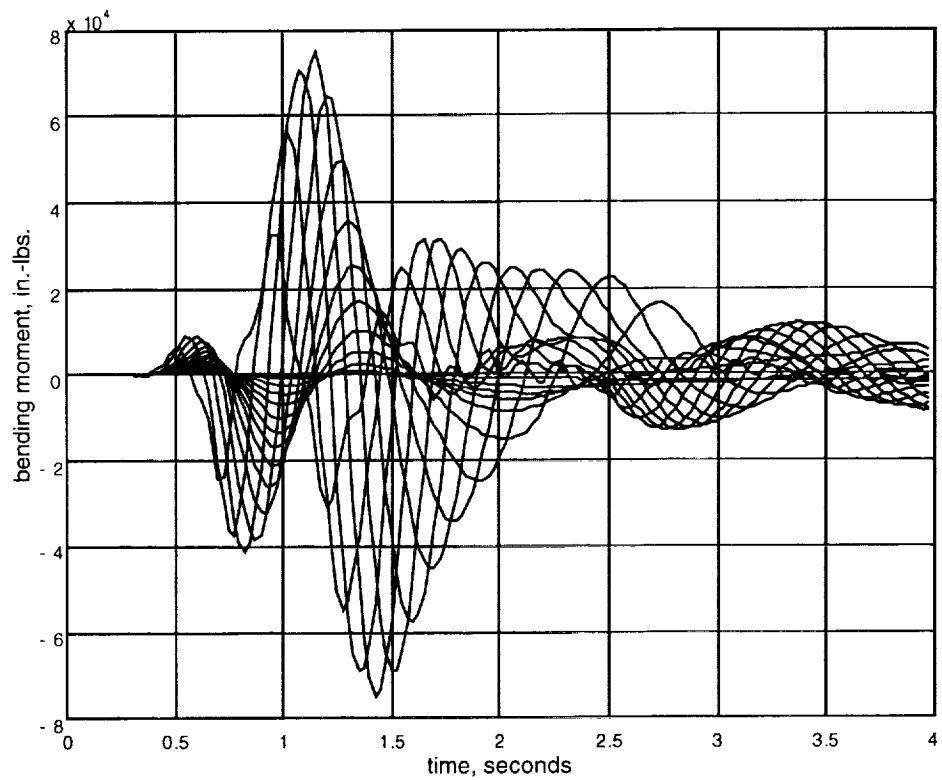


Figure 4.4: Tuned gust responses of in-plane wing root bending moment.

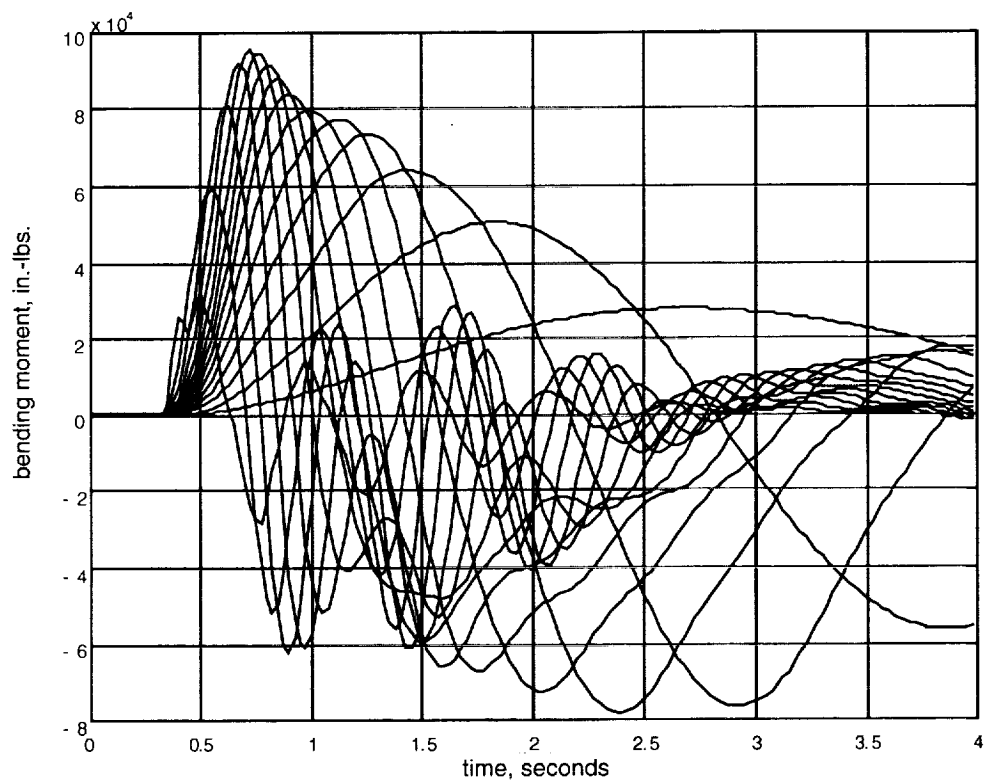


Figure 4.5: Tuned gust responses of vertical wing root bending moment.

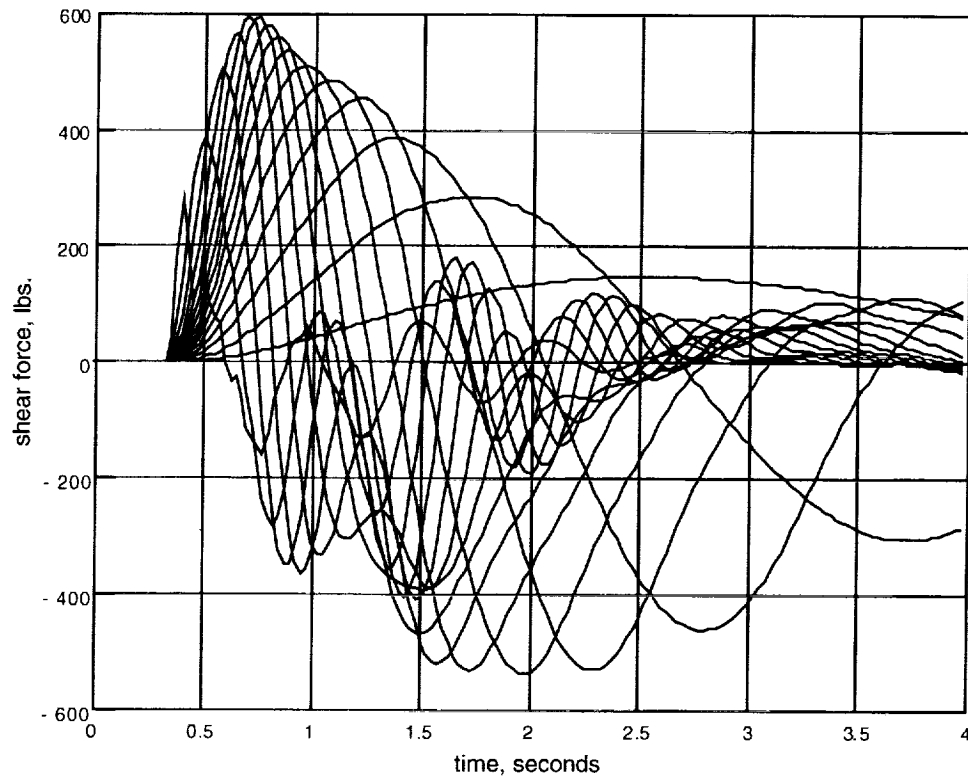


Figure 4.6: Tuned gust responses of vertical wing root shear force.

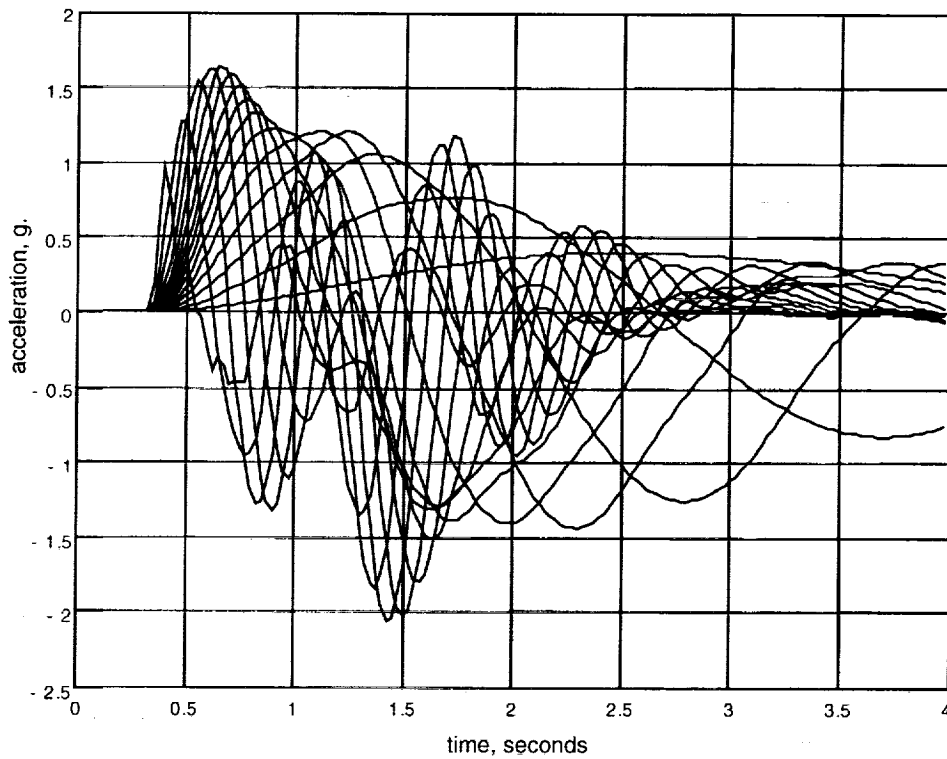


Figure 4.7: Tuned gust responses of vertical wing root acceleration.

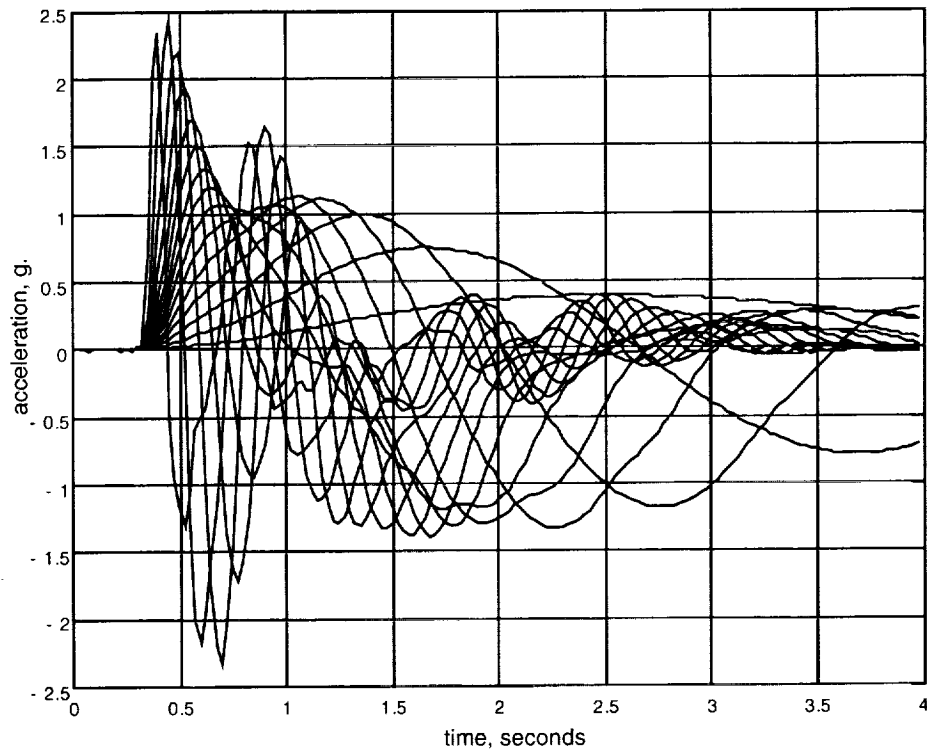


Figure 4.8: Tuned gust responses of vertical mid wing acceleration.

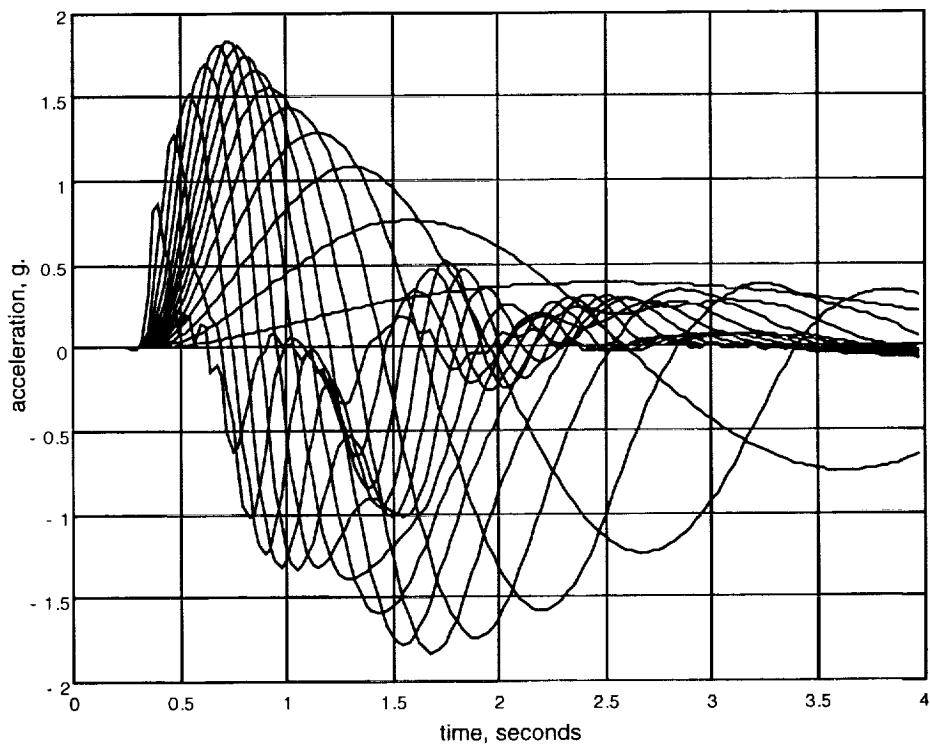


Figure 4.9: Tuned gust responses of vertical wing tip acceleration.

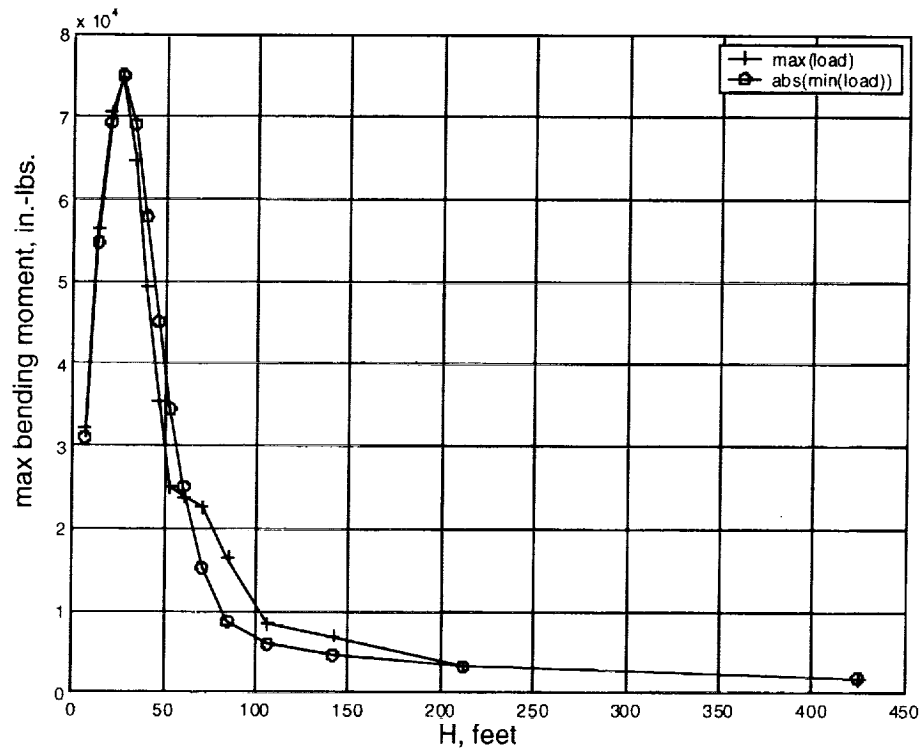


Figure 4.10: Maximum in-plane wing root bending moment.

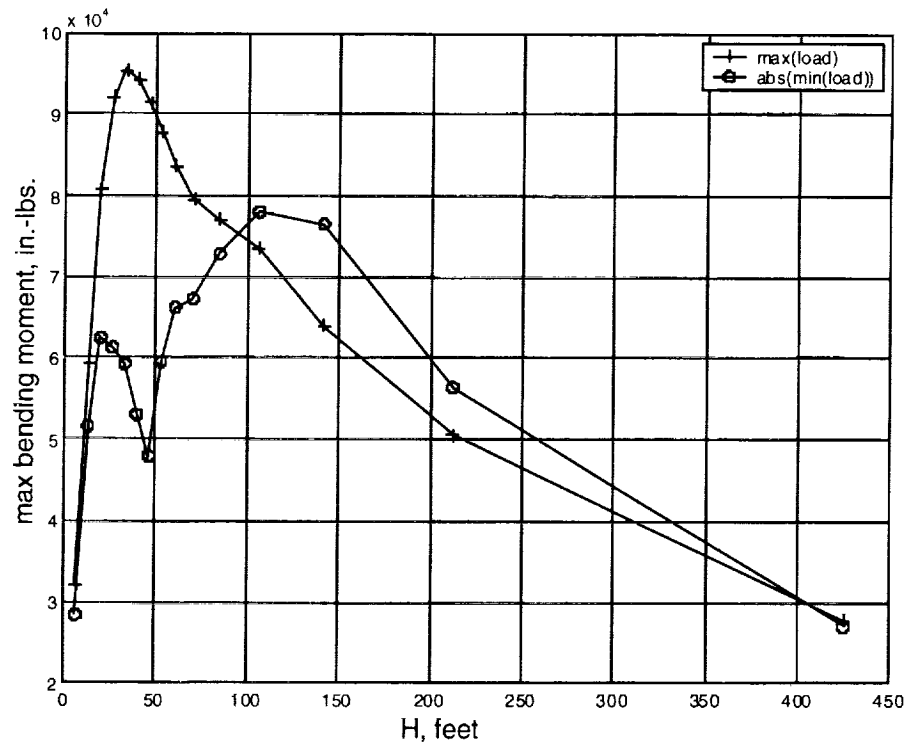


Figure 4.11: Maximum vertical wing root bending moment.

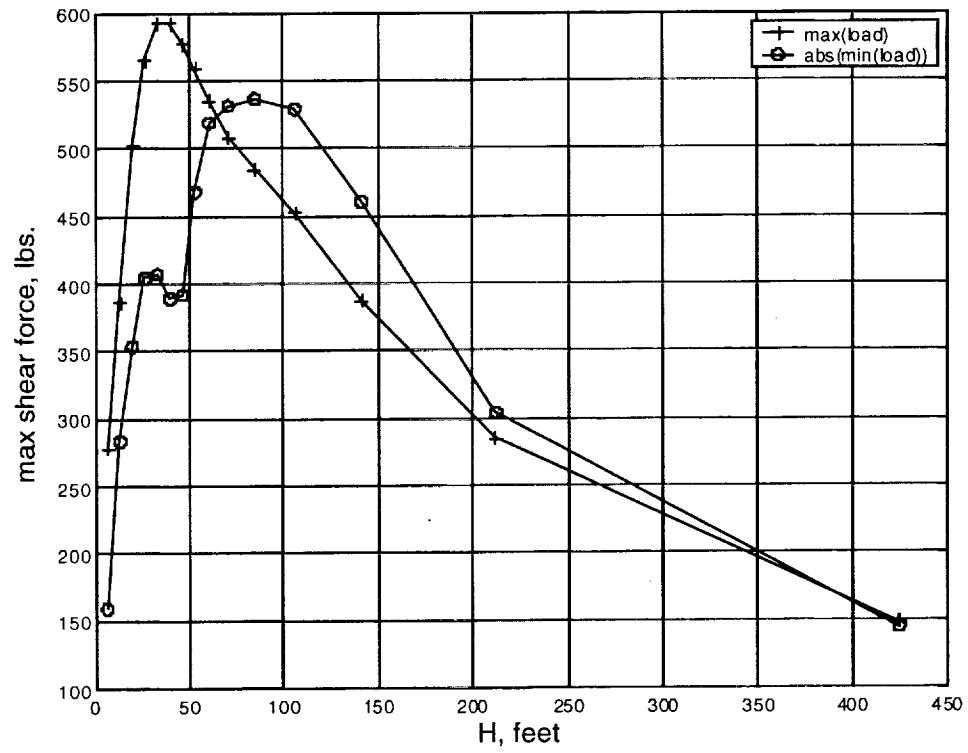


Figure 4.12: Maximum vertical wing root shear force.

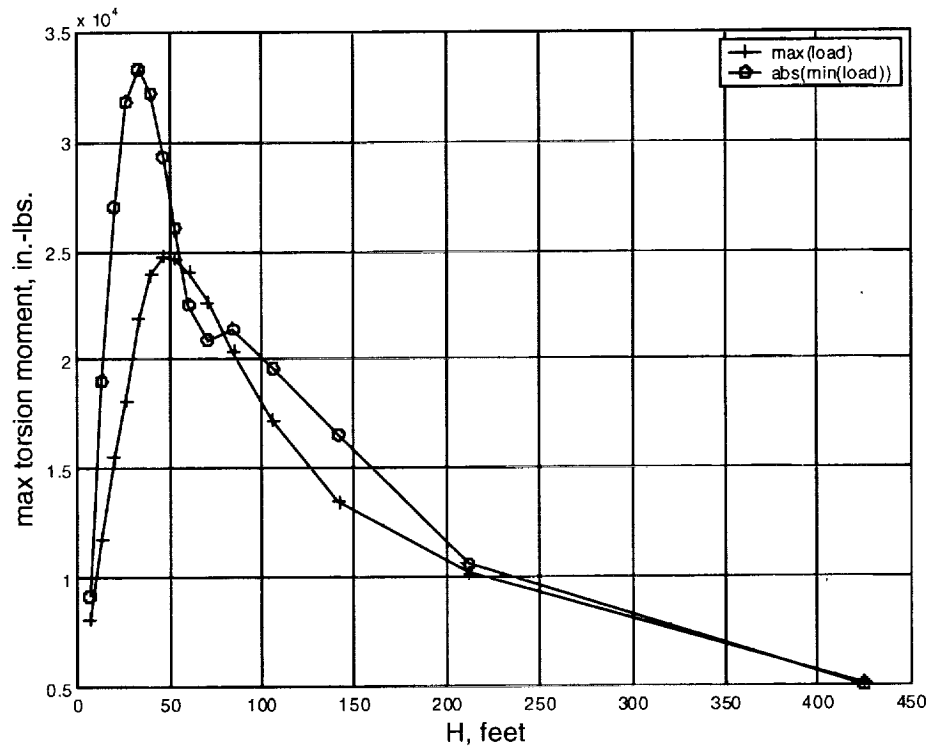


Figure 4.13: Maximum wing root torsion moment.

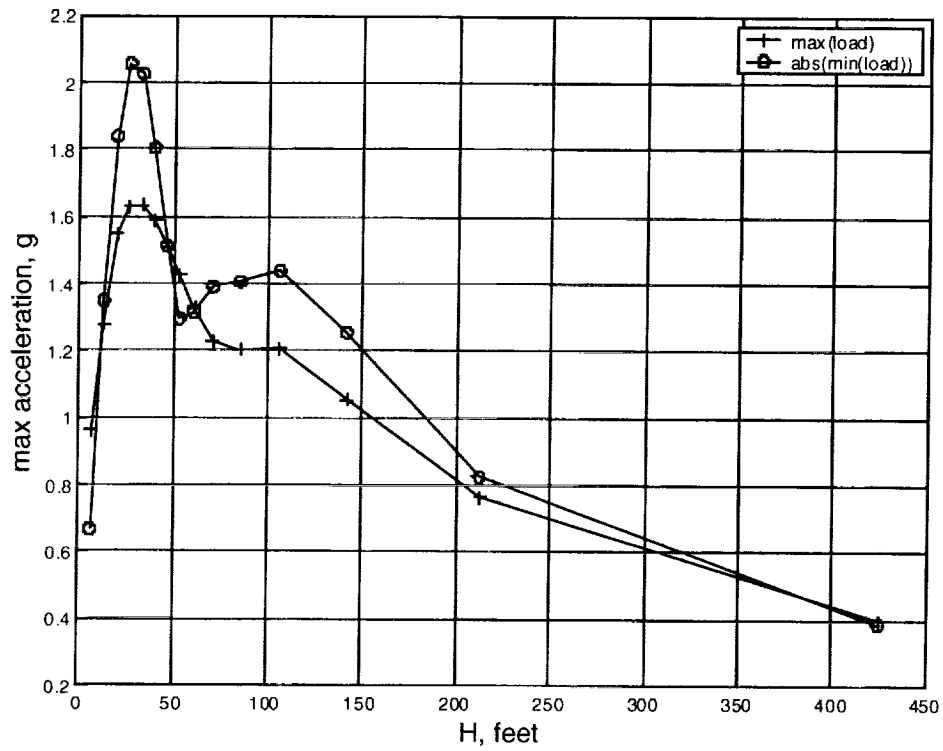


Figure 4.14: Maximum vertical wing root acceleration.

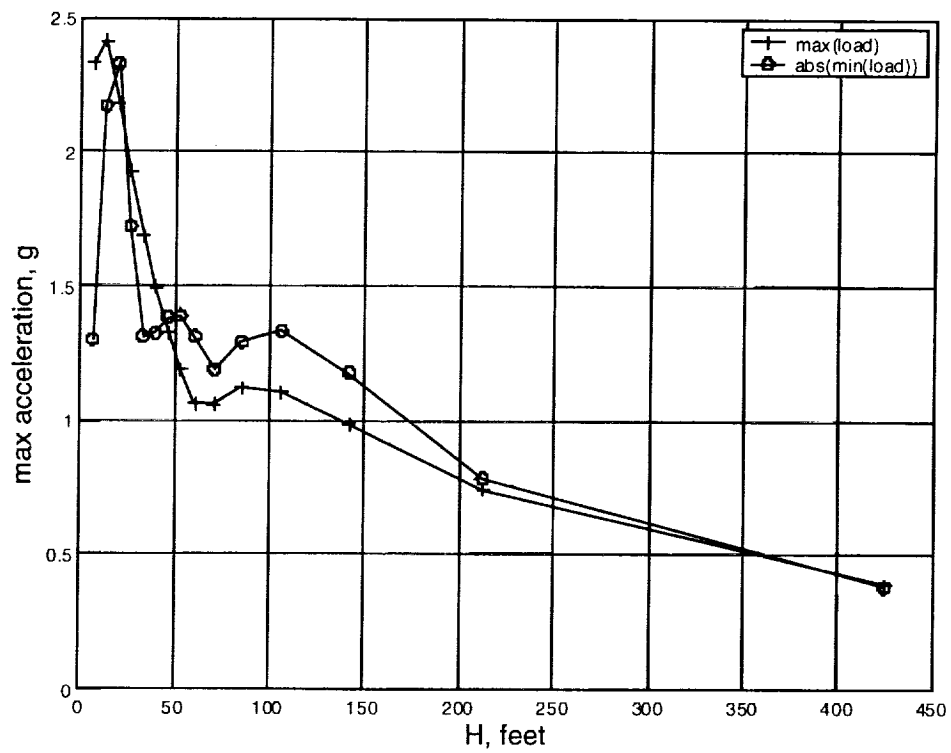


Figure 4.15: Maximum vertical mid wing acceleration.

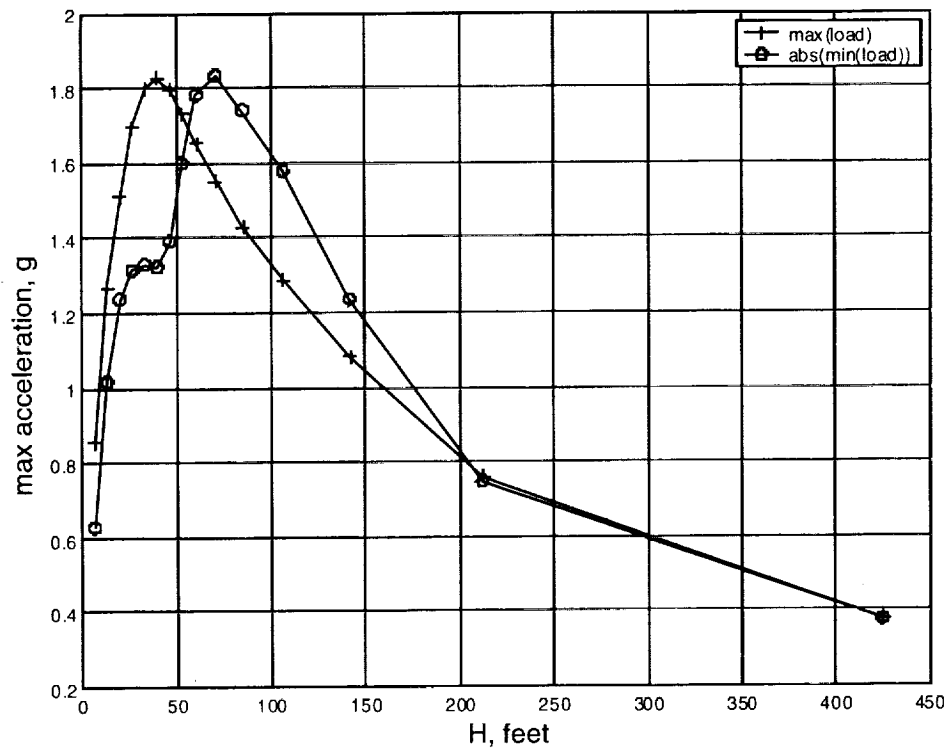


Figure 4.16: Maximum vertical wing tip acceleration.

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7. Using Matlab, Version 5, The Math Works Inc., 1997.
8. Crimaldi, J. P., Britt, R T., and Rodden, W. P.: "Response of the USAF/NORTHROP B-2 Aircraft to Nonuniform Spanwise Atmospheric Turbulence," AIAA/ASME/ASCE/AHS/ASC 32nd Structures, Structural Dynamics and Materials Conference, Baltimore, MD, April 8-10,1991, pp.1728-1741. AIAA-91-1048-CP.
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APPENDIX A

MSC/NASTRAN file used in the trim analysis of the semi-span model

```
$ TO EXECUTE THIS FILE USE THE FOLLOWING:
$ NASTRAN STATIC04 SCRATCH=YES MEM=8MW NEWS=NO
$
$ SOL 103 $ NORMAL MODES
SOL 144 $ STATIC AEROELASTICITY
$ SOL 145 $ FLUTTER SOLUTION
$ DIAG = 8,15 $ Matrix and Table trailers
TIME 20.00 $ time in minutes
$
CEND
TITLE = SYMMETRIC TRIM * MACH=0 * VEL=1000 IN/SEC AT SEA LEVEL
$ TITLE = SYMM. FREE-FREE FLUTTER * SEMISPAN MODEL * FULL FUEL
SUBTITLE = CHORDWISE GRIDS * SURFACE SPLINES
LABEL = SPC D.O.F. 1 AT GRID 101 * NO VERTICAL TAIL
$ METHOD = 1
$ FMETHOD = 30 $ ID of FLUTTER Bulk Data entry
ECHO = UNSORT
$ ECHO = NONE
$ MODE SHAPE OUTPUT REQUESTED FOR VELOCITY=880 IN/SEC (FLFACT 4)
TRIM = 1 $ TRIM VARIABLE CONSTRAINTS
DISPLACEMENT = ALL
APRES = ALL $ PRINT AERO. PRESSURES (ONLY IN SOL 144)
AEROF = ALL $ AERO. LOADS ON AERO. CONTROL POINTS (NOT IN SOL 145)
SPC = 1 $ BOUNDARY CONDITION CONSTRAINTS
SPCFORCES = ALL $ CONSTRAINT VECTOR OUTPUT
$
BEGIN BULK
$
$ LENGTH UNITS ARE INCHES, MASS UNITS ARE POUNDS
$
PARAM, POST, -2 $ IDEAS POST-PROCESSING
SUPOUT, 101, 35 $ DEFINE REACTION D.O.F. FOR FREE BODY
$
PARAM, OPPHIPA, 1 $ OUTPUT MODES AT ALL D.O.F. INCLUDING AERO D.O.F.
$
PARAM, LMODES, 10 $ USE THE 10 LOWEST NORMAL MODES
PARAM, VREF, 12.0 $ USE VELOCITY UNITS OF FEET/SECOND
PARAM, AUNITS, 0.002588 $ ALLOWS ACCELERATION UNITS IN G'S IN TRIM ENTRY
$
$ changes "weight" input data to "mass" data
PARAM,WTMASS,0.002588
$
$ requests mass properties summary
PARAM,GRDPNT,0
$
$ DEFINE LOCAL COORDINATE SYSTEMS FOR HORIZONTAL AND VERTICAL TAILS
SPC1, 1, 123456, 30, 40 $ GRIDS 30 AND 40 ONLY USED FOR ORIENTATION
GRID, 30, 0, 379.75, 521.5678, 100.0 $ DEFINES DIRECTION OF Z-AXIS (H-TAIL)
GRID, 40, 0, 410.39, 587.3362, 100.0 $ DEFINES DIRECTION OF Z-AXIS (V-TAIL)
$
$ COORDINATE SYSTEM 12 IS A REFERENCE AXIS SYSTEM FOR STABILITY DERIVATIVES
CORD2R 12 0 156.51 0.0 48.98 156.51 0.0 40.0 +CO12
+CO12 140.0 0.0 48.98
$ LOCAL COORD. SYSTEM FOR HORIZONTAL TAIL
CORD1R, 5, 301, 30, 2301 $ Z-AXIS NORMAL TO PLANE OF HORIZ. TAIL
$ LOCAL COORD. SYSTEM FOR VERTICAL TAIL
CORD1R, 6, 401, 40, 2401 $ Z-AXIS NORMAL TO PLANE OF VERT. TAIL
$
```

```

$ LOCAL COORDINATE SYSTEM TO DEFINE Y-AXIS OF RIGHT H-TAIL HINGE LINE
CORD2R      13      0 404.480 525.50 77.360 404.480521.5678 100.0 +CO13
+CO13      450.0531.888378.46955
$ LOCAL COORDINATE SYSTEM TO DEFINE Y-AXIS OF RIGHT V-TAIL HINGE LINE
CORD2R      14      0 433.14 496.50 157.190 433.140614.1537 200.0 +CO14
+CO14      500.0497.3168154.9451
$
CORD2C      1      0      0.      0.      0.      0.      0.      1.+FEMAPC1
+FEMAPC1    1.      0.      1.
CORD2S      2      0      0.      0.      0.      0.      0.      1.+FEMAPC2
+FEMAPC2    1.      0.      1.
$
$ SELECT THE DESIRED BOUNDARY CONDITIONS
$ Fixed Root
$ SPC      1      101 123456      0.
$
$ Symmetric BC
$ FOR AERO. STABILITY, CONSTRAIN D.O.F. 1 (X-DIRECTION)
SPC      1      101 1246      0.
$ SPC      1      101 246      0.
$
$ Antisymmetric BC
$ SPC      1      101 135      0.
$
$ *****
$ BEGIN AERODYNAMIC FLUTTER CARDS
$ *****
$
$ *****
$ SECTION FOR STATIC AEROELASTIC ANALYSIS
$ *****
$
$ CONSTRAINTS FOR AERODYNAMIC TRIM VARIABLES
$ MACH=0.0 , VELOCITY=1000.0 IN/SEC , SEA-LEVEL
TRIM      1      0.0      0.05734 PITCH      0.0      URDD3 -1.0      +TR01
+TR01      URDD5      0.0
$
AESTAT      70      ANGLEA
AESTAT      71      PITCH
AESTAT      73      URDD3
AESTAT      74      URDD5
$
AEROS      0      12      54.03      1236.0 31608.0 1      0
$
AESURF      80      HTAIL      13      90
AELIST      90      31001      THRU      31040
$ AESURF      81      VTAIL      14      91
$ AELIST      91      41001      THRU      41040
$
$ *****
$ END OF SECTION FOR STATIC AEROELASTIC ANALYSIS
$ *****
$
$ VALUE OF FIELD 6 (SYMZX) IS 1 FOR SYM CASE, -1 FOR ASYM, 0 FOR FIXED
$      2      3      4      5      6      7      8      9      1
$ AERO. DENSITY UNITS: LB-SEC**2/IN**4 (SEA-LEVEL)
AERO      0      0      54.03      1.145-7 1      0
$
$ Inboard Wing (RIGHT SIDE)
CAERO1 10001 1      0      17      8      1      +CA101
+CA101 132.83 0.0      48.98 59.2      134.33 223.5 60.77 54.03
$
$GRID 101      0      156.51      0.00 48.98

```

```

$ (156.51-132.83)/59.2=0.40 chord
$
$ Outboard Wing (RIGHT SIDE)
CAERO1 20001 1 0 23 8 1 +CA102
+CA102 134.33 223.5 60.77 54.03 138.03 525.5 76.79 41.28
$
$GRID 118 0 155.94 223.50 60.77
$ (155.94-134.33)/54.03=0.40 chord
$
$ RIGHT-SIDE HORIZONTAL TAIL - Corrected a touch (tip Z)
$ THE H-TAIL PANEL SPANS THE AREA FROM THE LEADING EDGE TO THE HINGE LINE
CAERO1 30001 1 0 20 8 1 +CA103
+CA103 355.08 525.5 77.36 49.40 366.04 620.5 93.92 24.704
$
$ RIGHT-SIDE CONTROL SURFACE PANEL ON HORIZONTAL TAIL
CAERO1 31001 1 0 20 2 1 +CA103A
+CA103A 404.480 525.50 77.360 12.35 390.744 620.50 93.920 6.176
$
$GRID 301 0 379.75 525.50 77.36
$ (379.75-355.08)/61.75=0.40 chord
$
$ RIGHT-SIDE VERTICAL TAIL - Corrected a bunch (Both x's and both chord lengths)
$ CAERO1 40001 1 0 16 8 1 +CA104
$ +CA104 390.67 525.5 77.5 49.3 407.54 496.5 157.19 32.00
$
$ REDEFINE POINTS 1 AND 4 FOR VERTICAL TAIL (SWAP POINTS 1 AND 4)
CAERO1 40001 1 0 20 8 1 +CA104
+CA104 407.54 496.5 157.19 25.60 390.67 525.5 77.5 39.44
$
$ RIGHT-SIDE CONTROL SURFACE PANEL ON VERTICAL TAIL
CAERO1 41001 1 0 20 2 1 +CA104A
+CA104A 433.140 496.50 157.190 6.40 430.110 525.50 77.50 9.86
$
$GRID 401 0 410.39 525.50 77.50
$ (410.39-390.67)/49.30=0.40 chord
$
$
$ DENS MACH VEL INTERP MODES PK TOL (0.001 default)
FLUTTER 30 PK 1 2 4 L 10
FLFACT 1 1.0
FLFACT 2 0.0
$
$ FLFACT 4 200.0 THRU 10000. 20
$ FOR PK METHOD, 'FLFACT 4' IS A VELOCITY TABLE (UNITS IN/SEC)
FLFACT 4 176.0 528.0 -880.0 1320.0 1760.0 2640.0 3520.0 +FL01
+FL01 4400.0 5280.0 4500.0 7040.0
$
$ 2 3 4 5 6 7 8 9 1
$
$ MKAERO1 0.0 +MK1
+MK1 .0001 .01 .05 .1 .2 .5 1.0 4.0
$
$ PAERO1 1
$
$ TEST USAGE OF SURFACE SPLINES ON ALL LIFTING SURFACES
$ SPLINE1 = 100 RIGHT-SIDE INBOARD WING
$ SPLINE1 = 200 RIGHT-SIDE OUTBOARD WING
$ SPLINE1 = 300 RIGHT-SIDE HORIZONTAL TAIL WITHOUT CONTROL SURFACE
$ SPLINE1 = 305 RIGHT-SIDE CONTROL SURFACE ON HORIZONTAL TAIL
$ SPLINE1 = 400 RIGHT-SIDE VERTICAL TAIL WITHOUT CONTROL SURFACE
$ SPLINE1 = 405 RIGHT-SIDE CONTROL SURFACE ON VERTICAL TAIL
$
$ SPLINE1 100 10001 10001 10136 100
$ SPLINE1 200 20001 20001 20184 200

```

```

$
SPLINE1 300      30001  30001  30160  300
SPLINE1 400      40001  40001  40160  400
$
SPLINE1 305      31001  31001  31040  305
SPLINE1 405      41001  41001  41040  405
$
$  GRIDS UTILIZED FOR RIGHT SIDE INBOARD WING SURFACE SPLINES
SET1      100      101      102      103      104      105      106      107+IW01
+IW01     108      109      110      111      112      113      114      115+IW02
+IW02     116      117      118      1101     1102     1103     1104     1105+IW03
+IW03     1106     1107     1108     1109     1110     1111     1112     1113+IW04
+IW04     1114     1115     1116     1117     1118     2101     2102     2103+IW05
+IW05     2104     2105     2106     2107     2108     2109     2110     2111+IW06
+IW06     2112     2113     2114     2115     2116     2117     2118
$  GRIDS UTILIZED FOR RIGHT SIDE OUTBOARD WING SURFACE SPLINES
SET1      200      118      119      120      121      122      123      124+OW01
+OW01     125      126      127      128      129      130      131      132+OW02
+OW02     133      134      135      136      137      138      139      140+OW03
+OW03     141      1118     1119     1120     1121     1122     1123     1124+OW04
+OW04     1125     1126     1127     1128     1129     1130     1131     1132+OW05
+OW05     1133     1134     1135     1136     1137     1138     1139     1140+OW06
+OW06     1141     2118     2119     2120     2121     2122     2123     2124+OW07
+OW07     2125     2126     2127     2128     2129     2130     2131     2132+OW08
+OW08     2133     2134     2135     2136     2137     2138     2139     2140+OW09
+OW09     2141
$  GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON H-TAIL
SET1      300      301      302      303      304      305      306      307+HT01
+HT01     308      309      310      311      1301     1302     1303     1304+HT02
+HT02     1305     1306     1307     1308     1309     1310     1311     2501+HT03
+HT03     2502     2503     2504     2505     2506     2507     2508     2509+HT04
+HT04     2510     2511
$  GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON H-TAIL CONTROL SURFACE
SET1      305      2501     2502     2503     2504     2505     2506     2507+HC01
+HC01     2508     2509     2510     2511     2301     2302     2303     2304+HC02
+HC02     2305     2306     2307     2308     2309     2310     2311
$  GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON V-TAIL
SET1      400      401      402      403      404      405      406      407+VT01
+VT01     408      409      410      411      1401     1402     1403     1404+VT02
+VT02     1405     1406     1407     1408     1409     1410     1411     2601+VT03
+VT03     2602     2603     2604     2605     2606     2607     2608     2609+VT04
+VT04     2610     2611
$  GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON V-TAIL CONTROL SURFACE
SET1      405      2601     2602     2603     2604     2605     2606     2607+VC01
+VC01     2608     2609     2610     2611     2401     2402     2403     2404+VC02
+VC02     2405     2406     2407     2408     2409     2410     2411
$
$ ***** END OF AERODYNAMIC FLUTTER INPUTS *****
$
EIGR      1      MGIV      10
$
$ EIGRL      1      10      0
$
$  BEAM PROPERTIES FOR RIGHT WING ELASTIC AXIS
PBEAM     101      1      1000.  1021.  247.3      0.  174.3      0.
PBEAM     102      1      1000.  1005.  227.7      0.  171.5      0.
PBEAM     103      1      1000.  989.3  208.8      0.  168.7      0.
PBEAM     104      1      1000.   974.  190.5      0.  166.      0.
PBEAM     105      1      1000.  958.7  173.      0.  163.3      0.
PBEAM     106      1      1000.  943.7  156.2      0.  160.6      0.
PBEAM     107      1      1000.  928.8  140.2      0.  157.9      0.
PBEAM     108      1      1000.   914.  124.8      0.  155.3      0.
PBEAM     109      1      1000.  899.4  110.3      0.  152.7      0.

```


PBEAM	110	1	1000.	885.	96.95	0.	150.1	0.
PBEAM	111	1	1000.	870.7	92.06	0.	147.6	0.
PBEAM	112	1	1000.	856.6	86.48	0.	145.1	0.
PBEAM	113	1	1000.	842.6	79.99	0.	142.6	0.
PBEAM	114	1	1000.	828.8	75.44	0.	140.1	0.
PBEAM	115	1	1000.	815.2	71.21	0.	137.7	0.
PBEAM	116	1	1000.	801.6	68.65	0.	135.3	0.
PBEAM	117	1	1000.	788.3	67.96	0.	133.	0.
PBEAM	118	1	1000.	769.7	66.91	0.	129.7	0.
PBEAM	119	1	1000.	746.1	65.52	0.	125.5	0.
PBEAM	120	1	1000.	723.1	64.11	0.	121.4	0.
PBEAM	121	1	1000.	700.5	62.75	0.	117.4	0.
PBEAM	122	1	1000.	678.4	61.39	0.	113.5	0.
PBEAM	123	1	1000.	656.7	60.02	0.	109.7	0.
PBEAM	124	1	1000.	635.5	58.67	0.	106.	0.
PBEAM	125	1	1000.	614.8	57.33	0.	102.3	0.
PBEAM	126	1	1000.	594.6	56.01	0.	98.78	0.
PBEAM	127	1	1000.	574.8	54.7	0.	95.3	0.
PBEAM	128	1	1000.	555.4	53.4	0.	91.91	0.
PBEAM	129	1	1000.	536.5	52.12	0.	88.6	0.
PBEAM	130	1	1000.	518.	50.86	0.	85.37	0.
PBEAM	131	1	1000.	499.9	49.61	0.	82.22	0.
PBEAM	132	1	1000.	482.3	48.37	0.	79.15	0.
PBEAM	133	1	1000.	465.1	47.15	0.	76.15	0.
PBEAM	134	1	1000.	448.3	45.95	0.	73.23	0.
PBEAM	135	1	1000.	431.9	44.76	0.	70.39	0.
PBEAM	136	1	1000.	415.9	43.58	0.	67.62	0.
PBEAM	137	1	1000.	400.3	42.42	0.	64.93	0.
PBEAM	138	1	1000.	385.1	41.27	0.	62.3	0.
PBEAM	139	1	1000.	370.3	40.14	0.	59.75	0.
PBEAM	140	1	1000.	355.9	39.03	0.	57.27	0.
\$ BEAM PROPERTIES FOR RIGHT WING TIP BOOM								
PBEAM	201	2	1000.	83.46	90.29	0.	238.6	0.
PBEAM	202	2	1000.	132.9	146.5	0.	238.6	0.
PBEAM	203	2	1000.	182.3	202.8	0.	238.6	0.
PBEAM	204	2	1000.	231.8	259.1	0.	238.6	0.
PBEAM	205	2	1000.	281.2	315.3	0.	238.6	0.
PBEAM	206	2	1000.	330.7	371.6	0.	238.6	0.
PBEAM	207	2	1000.	380.1	427.8	0.	238.6	0.
PBEAM	208	2	1000.	429.5	484.1	0.	238.6	0.
PBEAM	209	2	1000.	479.	540.4	0.	238.6	0.
PBEAM	210	2	1000.	528.4	596.6	0.	238.6	0.
PBEAM	211	2	1000.	577.8	652.9	0.	238.6	0.
PBEAM	212	2	1000.	627.3	709.1	0.	238.6	0.
PBEAM	213	2	1000.	676.7	765.4	0.	238.6	0.
PBEAM	214	2	1000.	726.2	821.7	0.	238.6	0.
PBEAM	215	2	1000.	704.4	793.9	0.	238.6	0.
PBEAM	216	2	1000.	682.7	766.2	0.	238.6	0.
PBEAM	217	2	1000.	661.	738.4	0.	238.6	0.
PBEAM	218	2	1000.	639.3	710.7	0.	238.6	0.
PBEAM	219	2	1000.	597.	659.8	0.	221.1	0.
PBEAM	220	2	1000.	556.2	610.7	0.	204.5	0.
PBEAM	221	2	1000.	516.7	563.3	0.	188.8	0.
PBEAM	222	2	1000.	478.6	517.7	0.	173.9	0.
PBEAM	223	2	1000.	441.9	473.7	0.	159.8	0.
PBEAM	224	2	1000.	406.6	431.5	0.	146.5	0.
PBEAM	225	2	1000.	372.6	391.1	0.	134.	0.
PBEAM	226	2	1000.	340.	352.3	0.	122.1	0.
PBEAM	227	2	1000.	308.8	315.3	0.	111.	0.
PBEAM	228	2	1000.	278.9	279.9	0.	100.6	0.
PBEAM	229	2	1000.	253.6	249.5	0.	113.6	0.
PBEAM	230	2	1000.	226.1	217.3	0.	102.3	0.
PBEAM	231	2	1000.	200.	186.8	0.	91.71	0.

PBEAM	232	2	1000.	177.6	160.2	0.	98.27	0.
PBEAM	233	2	1000.	153.9	132.9	0.	87.36	0.
PBEAM	234	2	1000.	131.7	107.3	0.	77.29	0.
PBEAM	235	2	1000.	112.4	85.01	0.	79.37	0.
PBEAM	236	2	1000.	94.08	64.02	0.	79.38	0.
PBEAM	237	2	1000.	75.6	43.23	0.	69.04	0.
PBEAM	238	2	1000.	59.53	25.2	0.	67.1	0.
PBEAM	239	2	1000.	44.55	8.614	0.	63.92	0.
PBEAM	240	2	1000.	30.7	8.007	0.	59.78	0.
PBEAM	241	2	1000.	14.37	3.655	0.	27.47	0.
PBEAM	242	2	1000.	3.024	3.024	0.	22.9	0.
PBEAM	301	3	1000.	1047.	54.91	0.	179.	0.
\$ BEAM PROPERTIES FOR RIGHT SIDE HORIZONTAL TAIL								
PBEAM	302	3	1000.	894.1	41.7	0.	151.7	0.
PBEAM	303	3	1000.	756.8	30.83	0.	127.4	0.
PBEAM	304	3	1000.	634.3	22.05	0.	105.8	0.
PBEAM	305	3	1000.	525.8	15.11	0.	86.74	0.
PBEAM	306	3	1000.	430.5	9.772	0.	70.15	0.
PBEAM	307	3	1000.	347.4	5.823	0.	55.82	0.
PBEAM	308	3	1000.	275.8	3.046	0.	43.59	0.
PBEAM	309	3	1000.	214.8	1.241	0.	33.28	0.
PBEAM	310	3	1000.	163.5	0.2188	0.	24.75	0.
\$ BEAM PROPERTIES FOR RIGHT SIDE VERTICAL TAIL								
PBEAM	401	4	1000.	542.6	24.42	0.	73.63	0.
PBEAM	402	4	1000.	486.7	18.52	0.	66.03	0.
PBEAM	403	4	1000.	434.7	13.68	0.	58.98	0.
PBEAM	404	4	1000.	386.6	9.785	0.	52.45	0.
PBEAM	405	4	1000.	342.1	6.712	0.	46.42	0.
PBEAM	406	4	1000.	301.3	4.35	0.	40.87	0.
PBEAM	407	4	1000.	263.8	2.599	0.	35.79	0.
PBEAM	408	4	1000.	229.5	1.365	0.	31.14	0.
PBEAM	409	4	1000.	198.4	0.5584	0.	26.91	0.
PBEAM	410	4	1000.	170.2	0.09922	0.	23.09	0.
\$								
\$ FEMAP Material 1 : Generic - WING AND CHORDWISE SPINES								
MAT1	11000000.1000000.	0.3	0.	0.	0.	0.	0.	
\$								
\$ FEMAP Material 1 : Generic - BOOM								
MAT1	21000000.1000000.	0.3	0.	0.	0.	0.	0.	
\$								
\$ FEMAP Material 1 : Generic - HORIZONTAL								
MAT1	31000000.1000000.	0.3	0.	0.	0.	0.	0.	
\$								
\$ FEMAP Material 1 : Generic - VERTICAL								
MAT1	41000000.1000000.	0.3	0.	0.	0.	0.	0.	
\$								
\$ GRID 100 REPRESENTS PROPULSION SYSTEM								
RBE2	504	101	123456	100				
\$ CONNECTIONS TO WING-TIP BOOM, HORIZONTAL AND VERTICAL TAILS								
\$								
RBE2	501	141	123456	216				
RBE2	502	238	123456	301				
RBE2	503	240	123456	401				
\$								
GRID	100	0	125.8	0.0	86.1	0		
\$								
\$ GRIDS FOR RIGHT WING BEAM								
\$								
GRID	101	0	156.51	0.00	48.98	0		
GRID	102	0	156.48	13.15	49.67	0		
GRID	103	0	156.45	26.29	50.37	0		
GRID	104	0	156.41	39.44	51.06	0		
GRID	105	0	156.38	52.59	51.75	0		

GRID	106	0	156.34	65.74	52.45	0
GRID	107	0	156.31	78.88	53.14	0
GRID	108	0	156.28	92.03	53.83	0
GRID	109	0	156.24	105.18	54.53	0
GRID	110	0	156.21	118.32	55.22	0
GRID	111	0	156.18	131.47	55.91	0
GRID	112	0	156.14	144.62	56.61	0
GRID	113	0	156.11	157.76	57.30	0
GRID	114	0	156.08	170.91	57.99	0
GRID	115	0	156.04	184.06	58.69	0
GRID	116	0	156.01	197.21	59.38	0
GRID	117	0	155.98	210.35	60.07	0
GRID	118	0	155.94	223.50	60.77	0
GRID	119	0	155.88	236.63	61.46	0
GRID	120	0	155.82	249.76	62.16	0
GRID	121	0	155.76	262.89	62.86	0
GRID	122	0	155.70	276.02	63.55	0
GRID	123	0	155.64	289.15	64.25	0
GRID	124	0	155.58	302.28	64.95	0
GRID	125	0	155.52	315.41	65.64	0
GRID	126	0	155.46	328.54	66.34	0
GRID	127	0	155.39	341.67	67.04	0
GRID	128	0	155.33	354.80	67.73	0
GRID	129	0	155.27	367.93	68.43	0
GRID	130	0	155.21	381.07	69.13	0
GRID	131	0	155.15	394.20	69.82	0
GRID	132	0	155.09	407.33	70.52	0
GRID	133	0	155.03	420.46	71.22	0
GRID	134	0	154.97	433.59	71.91	0
GRID	135	0	154.91	446.72	72.61	0
GRID	136	0	154.85	459.85	73.31	0
GRID	137	0	154.79	472.98	74.00	0
GRID	138	0	154.72	486.11	74.70	0
GRID	139	0	154.66	499.24	75.40	0
GRID	140	0	154.60	512.37	76.09	0
GRID	141	0	154.54	525.50	76.79	0

\$

\$ RIGHT SIDE WING SURFACE LEADING-EDGE GRID POINTS

\$

GRID	1101	0	132.83	0.00	48.98	0
GRID	1102	0	132.92	13.15	49.67	0
GRID	1103	0	133.01	26.29	50.37	0
GRID	1104	0	133.10	39.44	51.06	0
GRID	1105	0	133.18	52.59	51.75	0
GRID	1106	0	133.27	65.74	52.45	0
GRID	1107	0	133.36	78.88	53.14	0
GRID	1108	0	133.45	92.03	53.83	0
GRID	1109	0	133.54	105.18	54.53	0
GRID	1110	0	133.63	118.32	55.22	0
GRID	1111	0	133.71	131.47	55.91	0
GRID	1112	0	133.80	144.62	56.61	0
GRID	1113	0	133.89	157.76	57.30	0
GRID	1114	0	133.98	170.91	57.99	0
GRID	1115	0	134.07	184.06	58.69	0
GRID	1116	0	134.16	197.21	59.38	0
GRID	1117	0	134.24	210.35	60.07	0
GRID	1118	0	134.33	223.50	60.77	0
GRID	1119	0	134.49	236.63	61.46	0
GRID	1120	0	134.65	249.76	62.16	0
GRID	1121	0	134.81	262.89	62.86	0
GRID	1122	0	134.97	276.02	63.55	0
GRID	1123	0	135.14	289.15	64.25	0
GRID	1124	0	135.30	302.28	64.95	0

GRID	1125	0	135.46	315.41	65.64	0
GRID	1126	0	135.62	328.54	66.34	0
GRID	1127	0	135.78	341.67	67.04	0
GRID	1128	0	135.94	354.80	67.73	0
GRID	1129	0	136.10	367.93	68.43	0
GRID	1130	0	136.26	381.07	69.13	0
GRID	1131	0	136.42	394.20	69.82	0
GRID	1132	0	136.58	407.33	70.52	0
GRID	1133	0	136.74	420.46	71.22	0
GRID	1134	0	136.90	433.59	71.91	0
GRID	1135	0	137.06	446.72	72.61	0
GRID	1136	0	137.22	459.85	73.31	0
GRID	1137	0	137.38	472.98	74.00	0
GRID	1138	0	137.55	486.11	74.70	0
GRID	1139	0	137.71	499.24	75.40	0
GRID	1140	0	137.87	512.37	76.09	0
GRID	1141	0	138.03	525.50	76.79	0

\$

\$ RIGHT SIDE WING SURFACE TRAILING-EDGE GRID POINTS

\$

GRID	2101	0	192.03	0.00	48.98	0
GRID	2102	0	191.82	13.15	49.67	0
GRID	2103	0	191.60	26.29	50.37	0
GRID	2104	0	191.39	39.44	51.06	0
GRID	2105	0	191.17	52.59	51.75	0
GRID	2106	0	190.95	65.74	52.45	0
GRID	2107	0	190.74	78.88	53.14	0
GRID	2108	0	190.52	92.03	53.83	0
GRID	2109	0	190.30	105.18	54.53	0
GRID	2110	0	190.09	118.32	55.22	0
GRID	2111	0	189.87	131.47	55.91	0
GRID	2112	0	189.66	144.62	56.61	0
GRID	2113	0	189.44	157.76	57.30	0
GRID	2114	0	189.22	170.91	57.99	0
GRID	2115	0	189.01	184.06	58.69	0
GRID	2116	0	188.79	197.21	59.38	0
GRID	2117	0	188.58	210.35	60.07	0
GRID	2118	0	188.36	223.50	60.77	0
GRID	2119	0	187.97	236.63	61.46	0
GRID	2120	0	187.57	249.76	62.16	0
GRID	2121	0	187.18	262.89	62.86	0
GRID	2122	0	186.79	276.02	63.55	0
GRID	2123	0	186.39	289.15	64.25	0
GRID	2124	0	186.00	302.28	64.95	0
GRID	2125	0	185.61	315.41	65.64	0
GRID	2126	0	185.21	328.54	66.34	0
GRID	2127	0	184.82	341.67	67.04	0
GRID	2128	0	184.43	354.80	67.73	0
GRID	2129	0	184.03	367.93	68.43	0
GRID	2130	0	183.64	381.07	69.13	0
GRID	2131	0	183.25	394.20	69.82	0
GRID	2132	0	182.85	407.33	70.52	0
GRID	2133	0	182.46	420.46	71.22	0
GRID	2134	0	182.07	433.59	71.91	0
GRID	2135	0	181.67	446.72	72.61	0
GRID	2136	0	181.28	459.85	73.31	0
GRID	2137	0	180.89	472.98	74.00	0
GRID	2138	0	180.49	486.11	74.70	0
GRID	2139	0	180.10	499.24	75.40	0
GRID	2140	0	179.71	512.37	76.09	0
GRID	2141	0	179.31	525.50	76.79	0

\$

\$ RIGHT WING * LEADING AND TRAILING EDGE GRIDS ARE DEPENDENT ON MAIN BEAM

\$					
RBE2	1201	101	123456	1101	2101
RBE2	1202	102	123456	1102	2102
RBE2	1203	103	123456	1103	2103
RBE2	1204	104	123456	1104	2104
RBE2	1205	105	123456	1105	2105
RBE2	1206	106	123456	1106	2106
RBE2	1207	107	123456	1107	2107
RBE2	1208	108	123456	1108	2108
RBE2	1209	109	123456	1109	2109
RBE2	1210	110	123456	1110	2110
RBE2	1211	111	123456	1111	2111
RBE2	1212	112	123456	1112	2112
RBE2	1213	113	123456	1113	2113
RBE2	1214	114	123456	1114	2114
RBE2	1215	115	123456	1115	2115
RBE2	1216	116	123456	1116	2116
RBE2	1217	117	123456	1117	2117
RBE2	1218	118	123456	1118	2118
RBE2	1219	119	123456	1119	2119
RBE2	1220	120	123456	1120	2120
RBE2	1221	121	123456	1121	2121
RBE2	1222	122	123456	1122	2122
RBE2	1223	123	123456	1123	2123
RBE2	1224	124	123456	1124	2124
RBE2	1225	125	123456	1125	2125
RBE2	1226	126	123456	1126	2126
RBE2	1227	127	123456	1127	2127
RBE2	1228	128	123456	1128	2128
RBE2	1229	129	123456	1129	2129
RBE2	1230	130	123456	1130	2130
RBE2	1231	131	123456	1131	2131
RBE2	1232	132	123456	1132	2132
RBE2	1233	133	123456	1133	2133
RBE2	1234	134	123456	1134	2134
RBE2	1235	135	123456	1135	2135
RBE2	1236	136	123456	1136	2136
RBE2	1237	137	123456	1137	2137
RBE2	1238	138	123456	1138	2138
RBE2	1239	139	123456	1139	2139
RBE2	1240	140	123456	1140	2140
RBE2	1241	141	123456	1141	2141

\$

\$ GRIDS FOR RIGHT SIDE WING-TIP BOOM

\$

GRID	201	0	25.	525.5	77.5	0
GRID	202	0	33.6111	525.5	77.5	0
GRID	203	0	42.2222	525.5	77.5	0
GRID	204	0	50.8333	525.5	77.5	0
GRID	205	0	59.4444	525.5	77.5	0
GRID	206	0	68.0556	525.5	77.5	0
GRID	207	0	76.6667	525.5	77.5	0
GRID	208	0	85.2778	525.5	77.5	0
GRID	209	0	93.8889	525.5	77.5	0
GRID	210	0	102.5	525.5	77.5	0
GRID	211	0	111.111	525.5	77.5	0
GRID	212	0	119.722	525.5	77.5	0
GRID	213	0	128.333	525.5	77.5	0
GRID	214	0	136.944	525.5	77.5	0
GRID	215	0	145.556	525.5	77.5	0
GRID	216	0	154.167	525.5	77.5	0
GRID	217	0	162.778	525.5	77.5	0
GRID	218	0	171.389	525.5	77.5	0

GRID	219	0	180.	525.5	77.5	0
GRID	220	0	190.	525.5	77.5	0
GRID	221	0	200.	525.5	77.5	0
GRID	222	0	210.	525.5	77.5	0
GRID	223	0	220.	525.5	77.5	0
GRID	224	0	230.	525.5	77.5	0
GRID	225	0	240.	525.5	77.5	0
GRID	226	0	250.	525.5	77.5	0
GRID	227	0	260.	525.5	77.5	0
GRID	228	0	270.	525.5	77.5	0
GRID	229	0	280.	525.5	77.5	0
GRID	230	0	290.	525.5	77.5	0
GRID	231	0	300.	525.5	77.5	0
GRID	232	0	310.	525.5	77.5	0
GRID	233	0	320.	525.5	77.5	0
GRID	234	0	330.	525.5	77.5	0
GRID	235	0	340.	525.5	77.5	0
GRID	236	0	350.	525.5	77.5	0
GRID	237	0	360.	525.5	77.5	0
GRID	238	0	370.	525.5	77.5	0
GRID	239	0	380.	525.5	77.5	0
GRID	240	0	390.	525.5	77.5	0
GRID	241	0	400.	525.5	77.5	0
GRID	242	0	410.	525.5	77.5	0
GRID	243	0	420.	525.5	77.5	0

\$

\$ *****

\$ RIGHT SIDE HORIZONTAL TAIL DEFINITION

\$ *****

\$ GRIDS FOR RIGHT SIDE HORIZONTAL TAIL BEAM

\$

GRID	301	0	379.75	525.50	77.36	0
GRID	302	0	379.61	535.00	79.01	0
GRID	303	0	379.47	544.50	80.67	0
GRID	304	0	379.34	554.00	82.33	0
GRID	305	0	379.20	563.50	83.98	0
GRID	306	0	379.06	573.00	85.64	0
GRID	307	0	378.92	582.50	87.30	0
GRID	308	0	378.79	592.00	88.95	0
GRID	309	0	378.65	601.50	90.61	0
GRID	310	0	378.51	611.00	92.27	0
GRID	311	0	378.37	620.50	93.92	0

\$ DUPLICATE GRIDS FOR HORIZONTAL TAIL MAIN BEAM

\$ THE OUTPUT OF THESE GRIDS WILL BE IN COORD. SYST. 5

GRID	331	0	379.75	525.50	77.36	5
GRID	332	0	379.61	535.00	79.01	5
GRID	333	0	379.47	544.50	80.67	5
GRID	334	0	379.34	554.00	82.33	5
GRID	335	0	379.20	563.50	83.98	5
GRID	336	0	379.06	573.00	85.64	5
GRID	337	0	378.92	582.50	87.30	5
GRID	338	0	378.79	592.00	88.95	5
GRID	339	0	378.65	601.50	90.61	5
GRID	340	0	378.51	611.00	92.27	5
GRID	341	0	378.37	620.50	93.92	5

\$ DUPLICATE GRIDS ON H-TAIL ARE DEPENDENT ON ELASTIC AXIS BEAM

RBE2	521	301	123456	331
RBE2	522	302	123456	332
RBE2	523	303	123456	333
RBE2	524	304	123456	334
RBE2	525	305	123456	335
RBE2	526	306	123456	336
RBE2	527	307	123456	337

RBE2	528	308	123456	338
RBE2	529	309	123456	339
RBE2	530	310	123456	340
RBE2	531	311	123456	341

\$

\$ RIGHT SIDE HORIZONTAL TAIL LEADING EDGE

\$

GRID	1301	0	355.08	525.50	77.36	0
GRID	1302	0	356.17	535.00	79.01	0
GRID	1303	0	357.27	544.50	80.67	0
GRID	1304	0	358.36	554.00	82.33	0
GRID	1305	0	359.46	563.50	83.98	0
GRID	1306	0	360.56	573.00	85.64	0
GRID	1307	0	361.65	582.50	87.30	0
GRID	1308	0	362.75	592.00	88.95	0
GRID	1309	0	363.85	601.50	90.61	0
GRID	1310	0	364.94	611.00	92.27	0
GRID	1311	0	366.04	620.50	93.92	0

\$

\$ DISPLACEMENT OF H-TAIL L.E. IS DEPENDENT ON ELASTIC AXIS

RBE2	1251	301	123456	1301
RBE2	1252	302	123456	1302
RBE2	1253	303	123456	1303
RBE2	1254	304	123456	1304
RBE2	1255	305	123456	1305
RBE2	1256	306	123456	1306
RBE2	1257	307	123456	1307
RBE2	1258	308	123456	1308
RBE2	1259	309	123456	1309
RBE2	1260	310	123456	1310
RBE2	1261	311	123456	1311

\$

\$ DUPLICATE GRIDS FOR HORIZONTAL TAIL LEADING EDGE

\$ THE OUTPUT OF THESE GRIDS WILL BE IN COORD. SYST. 5

GRID	1331	0	355.08	525.50	77.36	5
GRID	1332	0	356.17	535.00	79.01	5
GRID	1333	0	357.27	544.50	80.67	5
GRID	1334	0	358.36	554.00	82.33	5
GRID	1335	0	359.46	563.50	83.98	5
GRID	1336	0	360.56	573.00	85.64	5
GRID	1337	0	361.65	582.50	87.30	5
GRID	1338	0	362.75	592.00	88.95	5
GRID	1339	0	363.85	601.50	90.61	5
GRID	1340	0	364.94	611.00	92.27	5
GRID	1341	0	366.04	620.50	93.92	5

\$ DUPLICATE GRIDS ON H-TAIL LEADING EDGE ARE DEPENDENT ON ELASTIC AXIS

RBE2	541	301	123456	1331
RBE2	542	302	123456	1332
RBE2	543	303	123456	1333
RBE2	544	304	123456	1334
RBE2	545	305	123456	1335
RBE2	546	306	123456	1336
RBE2	547	307	123456	1337
RBE2	548	308	123456	1338
RBE2	549	309	123456	1339
RBE2	550	310	123456	1340
RBE2	551	311	123456	1341

\$

\$ RIGHT SIDE HORIZONTAL TAIL TRAILING EDGE

\$

GRID	2301	0	416.83	525.50	77.36	0
GRID	2302	0	414.84	535.00	79.01	0
GRID	2303	0	412.85	544.50	80.67	0

GRID	2304	0	410.86	554.00	82.33	0
GRID	2305	0	408.87	563.50	83.98	0
GRID	2306	0	406.88	573.00	85.64	0
GRID	2307	0	404.88	582.50	87.30	0
GRID	2308	0	402.89	592.00	88.95	0
GRID	2309	0	400.90	601.50	90.61	0
GRID	2310	0	398.91	611.00	92.27	0
GRID	2311	0	396.92	620.50	93.92	0

\$ DUPLICATE GRIDS FOR HORIZONTAL TAIL TRAILING EDGE

\$ THE OUTPUT FOR THESE GRIDS WILL BE IN COORD. SYST. 5

GRID	2331	0	416.83	525.50	77.36	5
GRID	2332	0	414.84	535.00	79.01	5
GRID	2333	0	412.85	544.50	80.67	5
GRID	2334	0	410.86	554.00	82.33	5
GRID	2335	0	408.87	563.50	83.98	5
GRID	2336	0	406.88	573.00	85.64	5
GRID	2337	0	404.88	582.50	87.30	5
GRID	2338	0	402.89	592.00	88.95	5
GRID	2339	0	400.90	601.50	90.61	5
GRID	2340	0	398.91	611.00	92.27	5
GRID	2341	0	396.92	620.50	93.92	5

\$ DUPLICATE H-TAIL T.E. GRIDS ARE DEPENDENT ON ORIGINAL T.E. GRIDS

RBE2	561	2301	123456	2331
RBE2	562	2302	123456	2332
RBE2	563	2303	123456	2333
RBE2	564	2304	123456	2334
RBE2	565	2305	123456	2335
RBE2	566	2306	123456	2336
RBE2	567	2307	123456	2337
RBE2	568	2308	123456	2338
RBE2	569	2309	123456	2339
RBE2	570	2310	123456	2340
RBE2	571	2311	123456	2341

\$

\$ GRIDS AT 80% CHORD HINGE-LINE OF RIGHT SIDE HORIZONTAL TAIL

GRID	2501	0	404.480	525.500	77.360	0
GRID	2502	0	403.106	535.000	79.010	0
GRID	2503	0	401.734	544.500	80.670	0
GRID	2504	0	400.360	554.000	82.330	0
GRID	2505	0	398.988	563.500	83.980	0
GRID	2506	0	397.616	573.000	85.640	0
GRID	2507	0	396.234	582.500	87.300	0
GRID	2508	0	394.862	592.000	88.950	0
GRID	2509	0	393.490	601.500	90.610	0
GRID	2510	0	392.116	611.000	92.270	0
GRID	2511	0	390.744	620.500	93.920	0

\$

\$ *****

\$ END OF RIGHT SIDE HORIZONTAL TAIL DEFINITION

\$ *****

\$

\$ *****

\$ RIGHT SIDE VERTICAL TAIL DEFINITION

\$ *****

\$

\$ GRIDS FOR RIGHT SIDE VERTICAL TAIL BEAM

GRID	401	0	410.39	525.50	77.50	0
GRID	402	0	411.39	522.60	85.47	0
GRID	403	0	412.38	519.70	93.44	0
GRID	404	0	413.38	516.80	101.41	0
GRID	405	0	414.37	513.90	109.38	0
GRID	406	0	415.37	511.00	117.34	0
GRID	407	0	416.36	508.10	125.31	0

GRID	408	0	417.36	505.20	133.28	0
GRID	409	0	418.35	502.30	141.25	0
GRID	410	0	419.35	499.40	149.22	0
GRID	411	0	420.34	496.50	157.19	0
\$ THIS GROUP OF GRIDS GENERATES OUTPUT IN COORD. SYSTEM 6						
\$ THE Z-AXIS FOR COORD. SYS. 5 IS NORMAL TO PLANE OF V-TAIL						
GRID	431	0	410.39	525.50	77.50	6
GRID	432	0	411.39	522.60	85.47	6
GRID	433	0	412.38	519.70	93.44	6
GRID	434	0	413.38	516.80	101.41	6
GRID	435	0	414.37	513.90	109.38	6
GRID	436	0	415.37	511.00	117.34	6
GRID	437	0	416.36	508.10	125.31	6
GRID	438	0	417.36	505.20	133.28	6
GRID	439	0	418.35	502.30	141.25	6
GRID	440	0	419.35	499.40	149.22	6
GRID	441	0	420.34	496.50	157.19	6
\$ DUPLICATE GRIDS OF MAIN V-TAIL ARE DEPENDENT ON ELASTIC AXIS GRIDS						
RBE2	581	401	123456	431		
RBE2	582	402	123456	432		
RBE2	583	403	123456	433		
RBE2	584	404	123456	434		
RBE2	585	405	123456	435		
RBE2	586	406	123456	436		
RBE2	587	407	123456	437		
RBE2	588	408	123456	438		
RBE2	589	409	123456	439		
RBE2	590	410	123456	440		
RBE2	591	411	123456	441		
\$						
\$ RIGHT SIDE VERTICAL TAIL LEADING EDGE						
\$						
GRID	1401	0	390.67	525.50	77.50	0
GRID	1402	0	392.36	522.60	85.47	0
GRID	1403	0	394.05	519.70	93.44	0
GRID	1404	0	395.73	516.80	101.41	0
GRID	1405	0	397.42	513.90	109.38	0
GRID	1406	0	399.11	511.00	117.34	0
GRID	1407	0	400.79	508.10	125.31	0
GRID	1408	0	402.48	505.20	133.28	0
GRID	1409	0	404.17	502.30	141.25	0
GRID	1410	0	405.85	499.40	149.22	0
GRID	1411	0	407.54	496.50	157.19	0
\$						
\$ LEADING EDGE V-TAIL GRIDS ARE DEPENDENT ON ELASTIC AXIS						
RBE2	1271	401	123456	1401		
RBE2	1272	402	123456	1402		
RBE2	1273	403	123456	1403		
RBE2	1274	404	123456	1404		
RBE2	1275	405	123456	1405		
RBE2	1276	406	123456	1406		
RBE2	1277	407	123456	1407		
RBE2	1278	408	123456	1408		
RBE2	1279	409	123456	1409		
RBE2	1280	410	123456	1410		
RBE2	1281	411	123456	1411		
\$						
\$ DUPLICATE GRIDS FOR VERTICAL TAIL LEADING EDGE						
\$ THE OUTPUT OF THESE GRIDS WILL BE IN COORD. SYST. 6						
GRID	1431	0	390.67	525.50	77.50	6
GRID	1432	0	392.36	522.60	85.47	6
GRID	1433	0	394.05	519.70	93.44	6
GRID	1434	0	395.73	516.80	101.41	6

GRID	1435	0	397.42	513.90	109.38	6
GRID	1436	0	399.11	511.00	117.34	6
GRID	1437	0	400.79	508.10	125.31	6
GRID	1438	0	402.48	505.20	133.28	6
GRID	1439	0	404.17	502.30	141.25	6
GRID	1440	0	405.85	499.40	149.22	6
GRID	1441	0	407.54	496.50	157.19	6

\$ V-TAIL LEADING EDGE DUPLICATE GRIDS ARE DEPENDENT ON ELASTIC AXIS GRIDS

RBE2	601	401	123456	1431
RBE2	602	402	123456	1432
RBE2	603	403	123456	1433
RBE2	604	404	123456	1434
RBE2	605	405	123456	1435
RBE2	606	406	123456	1436
RBE2	607	407	123456	1437
RBE2	608	408	123456	1438
RBE2	609	409	123456	1439
RBE2	610	410	123456	1440
RBE2	611	411	123456	1441

\$

\$ RIGHT SIDE VERTICAL TAIL TRAILING EDGE

\$

GRID	2401	0	439.97	525.50	77.50	0
GRID	2402	0	439.93	522.60	85.47	0
GRID	2403	0	439.89	519.70	93.44	0
GRID	2404	0	439.84	516.80	101.41	0
GRID	2405	0	439.80	513.90	109.38	0
GRID	2406	0	439.76	511.00	117.34	0
GRID	2407	0	439.71	508.10	125.31	0
GRID	2408	0	439.67	505.20	133.28	0
GRID	2409	0	439.63	502.30	141.25	0
GRID	2410	0	439.58	499.40	149.22	0
GRID	2411	0	439.54	496.50	157.19	0

\$ DUPLICATE GRIDS FOR VERTICAL TAIL TRAILING EDGE

\$ THE OUTPUT FOR THESE GRIDS WILL BE IN COORD. SYST. 6

GRID	2431	0	439.97	525.50	77.50	6
GRID	2432	0	439.93	522.60	85.47	6
GRID	2433	0	439.89	519.70	93.44	6
GRID	2434	0	439.84	516.80	101.41	6
GRID	2435	0	439.80	513.90	109.38	6
GRID	2436	0	439.76	511.00	117.34	6
GRID	2437	0	439.71	508.10	125.31	6
GRID	2438	0	439.67	505.20	133.28	6
GRID	2439	0	439.63	502.30	141.25	6
GRID	2440	0	439.58	499.40	149.22	6
GRID	2441	0	439.54	496.50	157.19	6

\$ DUPLICATE V-TAIL T.E. GRIDS ARE DEPENDENT ON ORIGINAL GRIDS

RBE2	621	2401	123456	2431
RBE2	622	2402	123456	2432
RBE2	623	2403	123456	2433
RBE2	624	2404	123456	2434
RBE2	625	2405	123456	2435
RBE2	626	2406	123456	2436
RBE2	627	2407	123456	2437
RBE2	628	2408	123456	2438
RBE2	629	2409	123456	2439
RBE2	630	2410	123456	2440
RBE2	631	2411	123456	2441

\$

\$ GRIDS AT 80% CHORD HINGE-LINE OF RIGHT SIDE VERTICAL TAIL

GRID	2601	0	430.110	525.500	77.500	0
GRID	2602	0	430.416	522.600	85.470	0
GRID	2603	0	430.722	519.700	93.440	0

GRID	2604	0	431.018	516.800	101.410	0
GRID	2605	0	431.324	513.900	109.380	0
GRID	2606	0	431.630	511.000	117.340	0
GRID	2607	0	431.926	508.100	125.310	0
GRID	2608	0	432.232	505.200	133.280	0
GRID	2609	0	432.538	502.300	141.250	0
GRID	2610	0	432.834	499.400	149.220	0
GRID	2611	0	433.140	496.500	157.190	0

\$

\$

\$

END OF RIGHT SIDE VERTICAL TAIL DEFINITION

\$

\$

\$ MAIN BEAMS FOR RIGHT WING

CBEAM	101	101	101	102	-1.	0.	0.
CBEAM	102	102	102	103	-1.	0.	0.
CBEAM	103	103	103	104	-1.	0.	0.
CBEAM	104	104	104	105	-1.	0.	0.
CBEAM	105	105	105	106	-1.	0.	0.
CBEAM	106	106	106	107	-1.	0.	0.
CBEAM	107	107	107	108	-1.	0.	0.
CBEAM	108	108	108	109	-1.	0.	0.
CBEAM	109	109	109	110	-1.	0.	0.
CBEAM	110	110	110	111	-1.	0.	0.
CBEAM	111	111	111	112	-1.	0.	0.
CBEAM	112	112	112	113	-1.	0.	0.
CBEAM	113	113	113	114	-1.	0.	0.
CBEAM	114	114	114	115	-1.	0.	0.
CBEAM	115	115	115	116	-1.	0.	0.
CBEAM	116	116	116	117	-1.	0.	0.
CBEAM	117	117	117	118	-1.	0.	0.
CBEAM	118	118	118	119	-1.	0.	0.
CBEAM	119	119	119	120	-1.	0.	0.
CBEAM	120	120	120	121	-1.	0.	0.
CBEAM	121	121	121	122	-1.	0.	0.
CBEAM	122	122	122	123	-1.	0.	0.
CBEAM	123	123	123	124	-1.	0.	0.
CBEAM	124	124	124	125	-1.	0.	0.
CBEAM	125	125	125	126	-1.	0.	0.
CBEAM	126	126	126	127	-1.	0.	0.
CBEAM	127	127	127	128	-1.	0.	0.
CBEAM	128	128	128	129	-1.	0.	0.
CBEAM	129	129	129	130	-1.	0.	0.
CBEAM	130	130	130	131	-1.	0.	0.
CBEAM	131	131	131	132	-1.	0.	0.
CBEAM	132	132	132	133	-1.	0.	0.
CBEAM	133	133	133	134	-1.	0.	0.
CBEAM	134	134	134	135	-1.	0.	0.
CBEAM	135	135	135	136	-1.	0.	0.
CBEAM	136	136	136	137	-1.	0.	0.
CBEAM	137	137	137	138	-1.	0.	0.
CBEAM	138	138	138	139	-1.	0.	0.
CBEAM	139	139	139	140	-1.	0.	0.
CBEAM	140	140	140	141	-1.	0.	0.

\$ BEAMS FOR RIGHT WING TIP BOOM

CBEAM	201	201	201	202	0.	1.	0.
CBEAM	202	202	202	203	0.	1.	0.
CBEAM	203	203	203	204	0.	1.	0.
CBEAM	204	204	204	205	0.	1.	0.
CBEAM	205	205	205	206	0.	1.	0.
CBEAM	206	206	206	207	0.	1.	0.
CBEAM	207	207	207	208	0.	1.	0.
CBEAM	208	208	208	209	0.	1.	0.

CBEAM	209	209	209	210	0.	1.	0.
CBEAM	210	210	210	211	0.	1.	0.
CBEAM	211	211	211	212	0.	1.	0.
CBEAM	212	212	212	213	0.	1.	0.
CBEAM	213	213	213	214	0.	1.	0.
CBEAM	214	214	214	215	0.	1.	0.
CBEAM	215	215	215	216	0.	1.	0.
CBEAM	216	216	216	217	0.	1.	0.
CBEAM	217	217	217	218	0.	1.	0.
CBEAM	218	218	218	219	0.	1.	0.
CBEAM	219	219	219	220	0.	1.	0.
CBEAM	220	220	220	221	0.	1.	0.
CBEAM	221	221	221	222	0.	1.	0.
CBEAM	222	222	222	223	0.	1.	0.
CBEAM	223	223	223	224	0.	1.	0.
CBEAM	224	224	224	225	0.	1.	0.
CBEAM	225	225	225	226	0.	1.	0.
CBEAM	226	226	226	227	0.	1.	0.
CBEAM	227	227	227	228	0.	1.	0.
CBEAM	228	228	228	229	0.	1.	0.
CBEAM	229	229	229	230	0.	1.	0.
CBEAM	230	230	230	231	0.	1.	0.
CBEAM	231	231	231	232	0.	1.	0.
CBEAM	232	232	232	233	0.	1.	0.
CBEAM	233	233	233	234	0.	1.	0.
CBEAM	234	234	234	235	0.	1.	0.
CBEAM	235	235	235	236	0.	1.	0.
CBEAM	236	236	236	237	0.	1.	0.
CBEAM	237	237	237	238	0.	1.	0.
CBEAM	238	238	238	239	0.	1.	0.
CBEAM	239	239	239	240	0.	1.	0.
CBEAM	240	240	240	241	0.	1.	0.
CBEAM	241	241	241	242	0.	1.	0.
CBEAM	242	242	242	243	0.	1.	0.
\$ RIGHT SIDE HORIZONTAL TAIL BEAMS							
CBEAM	301	301	301	302	-1.	0.	0.
CBEAM	302	302	302	303	-1.	0.	0.
CBEAM	303	303	303	304	-1.	0.	0.
CBEAM	304	304	304	305	-1.	0.	0.
CBEAM	305	305	305	306	-1.	0.	0.
CBEAM	306	306	306	307	-1.	0.	0.
CBEAM	307	307	307	308	-1.	0.	0.
CBEAM	308	308	308	309	-1.	0.	0.
CBEAM	309	309	309	310	-1.	0.	0.
CBEAM	310	310	310	311	-1.	0.	0.
\$ RIGHT SIDE VERTICAL TAIL BEAMS							
CBEAM	401	401	401	402	1.	0.	0.
CBEAM	402	402	402	403	1.	0.	0.
CBEAM	403	403	403	404	1.	0.	0.
CBEAM	404	404	404	405	1.	0.	0.
CBEAM	405	405	405	406	1.	0.	0.
CBEAM	406	406	406	407	1.	0.	0.
CBEAM	407	407	407	408	1.	0.	0.
CBEAM	408	408	408	409	1.	0.	0.
CBEAM	409	409	409	410	1.	0.	0.
CBEAM	410	410	410	411	1.	0.	0.
\$							
\$ Fuselage Rigid Body Mass (50% for 1/2 symm model)							
\$							
CONM2	601	100	-1	446.1	125.80	0.00	86.1
+MASS601	2.64E5	0	8.90E5	0	0	6.95E5	0 MASS601
\$							
\$ *****							

\$ LUMPED MASSES FOR RIGHT-WING

\$ *****

\$ RIGHT WING

CONM2	602	102	-1	7.91	157.54	6.57	49.16	0 MASS602
CONM2	603	103	-1	7.75	157.67	19.72	49.83	0 MASS603
CONM2	604	104	-1	7.60	157.80	32.87	50.50	0 MASS604
CONM2	605	105	-1	7.45	157.92	46.01	51.17	0 MASS605
CONM2	606	106	-1	7.30	158.05	59.16	51.84	0 MASS606
CONM2	607	107	-1	7.16	158.17	72.31	52.51	0 MASS607
CONM2	608	108	-1	7.03	158.30	85.46	53.17	0 MASS608
CONM2	609	109	-1	6.90	158.42	98.60	53.84	0 MASS609
CONM2	610	110	-1	6.77	158.54	111.75	54.51	0 MASS610
CONM2	611	111	-1	6.66	158.65	124.90	55.18	0 MASS611
CONM2	612	112	-1	6.57	158.71	138.04	55.86	0 MASS612
CONM2	613	113	-1	6.49	158.77	151.19	56.54	0 MASS613
CONM2	614	114	-1	6.41	158.82	164.34	57.22	0 MASS614
CONM2	615	115	-1	6.35	158.83	177.49	57.91	0 MASS615
CONM2	616	116	-1	6.30	158.82	190.63	58.60	0 MASS616
CONM2	617	117	-1	6.26	158.79	203.78	59.29	0 MASS617
CONM2	618	118	-1	6.24	158.74	216.93	59.99	0 MASS618
CONM2	619	119	-1	6.19	158.66	230.07	60.69	0 MASS619

\$

+MASS602	114.0	0	2357.1	0	0	2471.1
+MASS603	111.7	0	2285.6	0	0	2397.2
+MASS604	109.4	0	2216.7	0	0	2326.1
+MASS605	107.3	0	2150.3	0	0	2257.6
+MASS606	105.2	0	2086.5	0	0	2191.6
+MASS607	103.2	0	2025.0	0	0	2128.2
+MASS608	101.2	0	1966.0	0	0	2067.2
+MASS609	99.4	0	1909.2	0	0	2008.6
+MASS610	97.6	0	1854.7	0	0	1952.3
+MASS611	95.9	0	1802.8	0	0	1898.7
+MASS612	94.6	0	1760.2	0	0	1854.9
+MASS613	93.4	0	1719.1	0	0	1812.6
+MASS614	92.3	0	1679.5	0	0	1771.8
+MASS615	91.5	0	1646.6	0	0	1738.0
+MASS616	90.7	0	1615.4	0	0	1706.1
+MASS617	90.2	0	1587.8	0	0	1678.0
+MASS618	89.8	0	1563.6	0	0	1653.4
+MASS619	88.9	0	1527.9	0	0	1616.9

\$

\$ *****

\$ BEGIN FUEL STATIONS

\$ *****

\$

\$ No Fuel

\$

\$CONM2	620	120	-1	6.14	158.56	243.20	61.53	0 MASS620
\$CONM2	621	121	-1	6.10	158.46	256.33	62.23	0 MASS621
\$CONM2	622	122	-1	6.05	158.36	269.46	62.93	0 MASS622
\$CONM2	623	123	-1	6.00	158.26	282.59	63.63	0 MASS623
\$CONM2	624	124	-1	5.95	158.16	295.72	64.33	0 MASS624
\$CONM2	625	125	-1	5.91	158.06	308.85	65.03	0 MASS625
\$CONM2	626	126	-1	5.86	157.96	321.98	65.73	0 MASS626

\$

\$ No Fuel

\$

+\$MASS620	88.3	0	1485.1	0	0	1573.4
+\$MASS621	87.6	0	1443.1	0	0	1530.7
+\$MASS622	86.9	0	1402.0	0	0	1488.9
+\$MASS623	86.2	0	1361.5	0	0	1447.8
+\$MASS624	85.5	0	1321.9	0	0	1407.5
+\$MASS625	84.9	0	1283.1	0	0	1367.9

\$+MASS626	84.2	0	1245.0	0	0	1329.1		
\$								
\$ With Fuel								
\$								
CONM2	620	120	-1	56.86	157.65	243.20	61.53	0 MASS620
CONM2	621	121	-1	55.70	157.57	256.33	62.23	0 MASS621
CONM2	622	122	-1	54.55	157.49	269.46	62.93	0 MASS622
CONM2	623	123	-1	53.41	157.41	282.59	63.63	0 MASS623
CONM2	624	124	-1	52.28	157.33	295.72	64.33	0 MASS624
CONM2	625	125	-1	51.17	157.25	308.85	65.03	0 MASS625
CONM2	626	126	-1	50.07	157.17	321.98	65.73	0 MASS626
\$								
\$ With Fuel								
\$								
+MASS620	816.9	0	8807.9	0	0	9165.0		
+MASS621	800.2	0	8456.6	0	0	8805.8		
+MASS622	783.7	0	8116.0	0	0	8457.4		
+MASS623	767.3	0	7785.8	0	0	8119.6		
+MASS624	751.2	0	7465.9	0	0	7792.1		
+MASS625	735.2	0	7156.0	0	0	7474.7		
+MASS626	719.4	0	6856.0	0	0	7167.2		
\$								
\$	*****							
\$	END FUEL STATIONS							
\$	*****							
\$								
CONM2	627	127	-1	5.81	157.86	335.11	66.31	0 MASS627
CONM2	628	128	-1	5.76	157.76	348.24	67.01	0 MASS628
CONM2	629	129	-1	5.72	157.66	361.37	67.71	0 MASS629
CONM2	630	130	-1	5.67	157.56	374.50	68.42	0 MASS630
CONM2	631	131	-1	5.62	157.46	387.63	69.12	0 MASS631
CONM2	632	132	-1	5.58	157.37	400.76	69.82	0 MASS632
CONM2	633	133	-1	5.53	157.27	413.89	70.52	0 MASS633
CONM2	634	134	-1	5.48	157.17	427.02	71.23	0 MASS634
CONM2	635	135	-1	5.43	157.07	440.15	71.93	0 MASS635
CONM2	636	136	-1	12.39	155.86	453.28	72.81	0 MASS636
CONM2	637	137	-1	5.34	156.87	466.41	73.33	0 MASS637
CONM2	638	138	-1	12.29	155.76	479.54	74.19	0 MASS638
CONM2	639	139	-1	5.24	156.67	492.67	74.74	0 MASS639
CONM2	640	140	-1	12.20	155.67	505.80	75.58	0 MASS640
CONM2	641	141	-1	5.15	156.47	518.93	76.14	0 MASS641
\$								
+MASS627	83.5	0	1207.6	0	0	1291.1		
+MASS628	82.8	0	1171.0	0	0	1253.8		
+MASS629	82.1	0	1135.2	0	0	1217.3		
+MASS630	81.5	0	1100.0	0	0	1181.5		
+MASS631	80.8	0	1065.6	0	0	1146.4		
+MASS632	80.1	0	1031.9	0	0	1112.0		
+MASS633	79.4	0	999.0	0	0	1078.4		
+MASS634	78.7	0	966.7	0	0	1045.4		
+MASS635	78.1	0	935.1	0	0	1013.2		
+MASS636	77.4	0	974.4	0	0	974.4		
+MASS637	76.7	0	874.0	0	0	950.7		
+MASS638	76.0	0	912.3	0	0	912.3		
+MASS639	75.3	0	815.6	0	0	890.9		
+MASS640	74.7	0	853.1	0	0	853.1		
+MASS641	74.0	0	759.8	0	0	833.8		
\$								
\$	LUMPED MASSES ON RIGHT WING-TIP BOOM							
CONM2	702	202	-1	11.25	33.61	525.50	77.50	0 MASS702
CONM2	703	203	-1	16.33	42.22	525.50	77.50	0 MASS703
CONM2	704	204	-1	16.41	50.83	525.50	77.50	0 MASS704
CONM2	705	205	-1	11.48	59.44	525.50	77.50	0 MASS705

CONM2	706	206	-1	1.56	68.06	525.50	77.50	0 MASS706
CONM2	707	207	-1	1.64	76.67	525.50	77.50	0 MASS707
CONM2	708	208	-1	1.72	85.28	525.50	77.50	0 MASS708
CONM2	709	209	-1	1.79	93.89	525.50	77.50	0 MASS709
CONM2	710	210	-1	1.87	102.50	525.50	77.50	0 MASS710
CONM2	711	211	-1	1.95	111.11	525.50	77.50	0 MASS711
CONM2	712	212	-1	2.02	119.72	525.50	77.50	0 MASS712
CONM2	713	213	-1	2.10	128.33	525.50	77.50	0 MASS713
CONM2	714	214	-1	2.18	136.94	525.50	77.50	0 MASS714
CONM2	715	215	-1	2.25	145.56	525.50	77.50	0 MASS715
CONM2	716	216	-1	2.22	154.17	525.50	77.50	0 MASS716
CONM2	717	217	-1	2.18	162.78	525.50	77.50	0 MASS717
CONM2	718	218	-1	5.65	171.39	525.50	77.50	0 MASS718
CONM2	719	219	-1	2.11	180.00	525.50	77.50	0 MASS719
CONM2	720	220	-1	2.41	190.00	525.50	77.50	0 MASS720
CONM2	721	221	-1	2.35	200.00	525.50	77.50	0 MASS721
CONM2	722	222	-1	2.30	210.00	525.50	77.50	0 MASS722
CONM2	723	223	-1	2.24	220.00	525.50	77.50	0 MASS723
CONM2	724	224	-1	2.17	230.00	525.50	77.50	0 MASS724
CONM2	725	225	-1	2.11	240.00	525.50	77.50	0 MASS725
CONM2	726	226	-1	2.05	250.00	525.50	77.50	0 MASS726
CONM2	727	227	-1	1.98	260.00	525.50	77.50	0 MASS727
CONM2	728	228	-1	1.91	270.00	525.50	77.50	0 MASS728
CONM2	729	229	-1	1.84	280.00	525.50	77.50	0 MASS729
CONM2	730	230	-1	1.89	290.00	525.50	77.50	0 MASS730
CONM2	731	231	-1	1.81	300.00	525.50	77.50	0 MASS731
CONM2	732	232	-1	1.73	310.00	525.50	77.50	0 MASS732
CONM2	733	233	-1	1.76	320.00	525.50	77.50	0 MASS733
CONM2	734	234	-1	1.66	330.00	525.50	77.50	0 MASS734
CONM2	735	235	-1	1.56	340.00	525.50	77.50	0 MASS735
CONM2	736	236	-1	1.56	350.00	525.50	77.50	0 MASS736
CONM2	737	237	-1	1.54	360.00	525.50	77.50	0 MASS737
CONM2	738	238	-1	1.42	370.00	525.50	77.50	0 MASS738
CONM2	739	239	-1	1.37	380.00	525.50	77.50	0 MASS739
CONM2	740	240	-1	1.31	390.00	525.50	77.50	0 MASS740
CONM2	741	241	-1	1.29	400.00	525.50	77.50	0 MASS741
CONM2	742	242	-1	0.80	410.00	525.50	77.50	0 MASS742
CONM2	743	243	-1	0.71	420.00	525.50	77.50	0 MASS743

\$

\$

+MASS702	316.5	0	126.6	0	0	126.6
+MASS703	459.3	0	330.6	0	0	330.6
+MASS704	461.5	0	332.1	0	0	332.1
+MASS705	323.0	0	232.5	0	0	232.5
+MASS706	87.8	0	53.6	0	0	53.6
+MASS707	92.2	0	56.2	0	0	56.2
+MASS708	96.5	0	58.8	0	0	58.8
+MASS709	100.8	0	61.5	0	0	61.5
+MASS710	105.1	0	64.1	0	0	64.1
+MASS711	109.5	0	66.8	0	0	66.8
+MASS712	113.8	0	69.4	0	0	69.4
+MASS713	118.1	0	72.0	0	0	72.0
+MASS714	122.5	0	74.7	0	0	74.7
+MASS715	126.8	0	77.3	0	0	77.3
+MASS716	124.8	0	76.1	0	0	76.1
+MASS717	122.7	0	74.9	0	0	74.9
+MASS718	158.8	0	114.3	0	0	114.3
+MASS719	118.7	0	72.4	0	0	72.4
+MASS720	128.9	0	84.6	0	0	84.6
+MASS721	119.5	0	79.4	0	0	79.4
+MASS722	110.5	0	74.4	0	0	74.4
+MASS723	101.8	0	69.6	0	0	69.6
+MASS724	93.6	0	64.9	0	0	64.9

+MASS725	85.8	0	60.5	0	0	60.5	
+MASS726	78.3	0	56.2	0	0	56.2	
+MASS727	71.3	0	52.1	0	0	52.1	
+MASS728	64.5	0	48.2	0	0	48.2	
+MASS729	58.2	0	44.4	0	0	44.4	
+MASS730	56.0	0	43.8	0	0	43.8	
+MASS731	50.0	0	40.1	0	0	40.1	
+MASS732	44.3	0	36.6	0	0	36.6	
+MASS733	41.8	0	35.5	0	0	35.5	
+MASS734	36.5	0	32.1	0	0	32.1	
+MASS735	31.6	0	28.8	0	0	28.8	
+MASS736	29.0	0	27.5	0	0	27.5	
+MASS737	26.2	0	26.0	0	0	26.0	
+MASS738	21.9	0	22.8	0	0	22.8	
+MASS739	19.3	0	21.1	0	0	21.1	
+MASS740	16.6	0	19.2	0	0	19.2	
+MASS741	14.7	0	18.1	0	0	18.1	
+MASS742	8.1	0	10.7	0	0	10.7	
+MASS743	6.4	0	9.1	0	0	9.1	
\$ LUMPED MASSES FOR RIGHT SIDE HORIZONTAL TAIL							
CONM2	802	302	-1	4.97	387.10	530.25	77.80 0 MASS802
CONM2	803	303	-1	4.73	386.66	539.75	79.47 0 MASS803
CONM2	804	304	-1	7.69	387.79	549.25	81.06 0 MASS804
CONM2	805	305	-1	4.26	385.75	558.75	82.82 0 MASS805
CONM2	806	306	-1	4.03	385.29	568.25	84.49 0 MASS806
CONM2	807	307	-1	7.00	387.18	577.75	86.04 0 MASS807
CONM2	808	308	-1	3.58	384.33	587.25	87.84 0 MASS808
CONM2	809	309	-1	3.35	383.83	596.75	89.51 0 MASS809
CONM2	810	310	-1	6.34	386.70	606.25	91.01 0 MASS810
CONM2	811	311	-1	2.92	382.81	615.75	92.87 0 MASS811
\$							
+MASS802	37.4	0	1504.7	0	0	1542.1	
+MASS803	35.6	0	1289.2	0	0	1324.7	
+MASS804	33.8	0	1149.5	0	0	1149.5	
+MASS805	32.0	0	923.6	0	0	955.6	
+MASS806	30.3	0	770.9	0	0	801.2	
+MASS807	28.6	0	710.0	0	0	710.0	
+MASS808	26.9	0	519.2	0	0	546.1	
+MASS809	25.2	0	417.6	0	0	442.8	
+MASS810	23.6	0	427.7	0	0	427.7	
+MASS811	22.0	0	256.7	0	0	278.7	
\$ LUMPED MASSES FOR RIGHT SIDE VERTICAL TAIL							
CONM2	902	402	-1	3.06	413.63	524.05	81.48 0 MASS902
CONM2	903	403	-1	2.91	414.65	521.15	89.45 0 MASS903
CONM2	904	404	-1	5.97	418.34	518.25	97.42 0 MASS904
CONM2	905	405	-1	2.63	416.67	515.35	105.39 0 MASS905
CONM2	906	406	-1	2.49	417.67	512.45	113.36 0 MASS906
CONM2	907	407	-1	2.36	418.66	509.55	121.33 0 MASS907
CONM2	908	408	-1	5.43	422.59	506.65	129.30 0 MASS908
CONM2	909	409	-1	2.1	420.61	503.75	137.27 0 MASS909
CONM2	910	410	-1	1.98	421.57	500.85	145.23 0 MASS910
CONM2	911	411	-1	1.86	422.50	497.95	153.20 0 MASS911
\$							
+MASS902	18.3	0	616.3	0	0	597.9	
+MASS903	17.5	0	547.1	0	0	529.7	
+MASS904	16.6	0	483.7	0	0	467.1	
+MASS905	15.8	0	425.8	0	0	410.0	
+MASS906	14.9	0	373.1	0	0	358.2	
+MASS907	14.1	0	325.3	0	0	311.2	
+MASS908	13.3	0	282.3	0	0	269.0	
+MASS909	12.6	0	243.7	0	0	231.1	
+MASS910	11.8	0	209.3	0	0	197.5	
+MASS911	11.1	0	178.9	0	0	167.8	

\$
 \$
 PBEAM 2301 1 100. 1000. 1000. 0. 1000.
 PBEAM 2401 1 100. 1000. 1000. 0. 1000.
 \$
 \$ RIGHT SIDE BEAMS FROM H-TAIL MAIN BEAM TO HINGE LINE
 CBEAM 2301 2301 301 2501 302
 CBEAM 2302 2301 302 2502 301
 CBEAM 2303 2301 303 2503 301
 CBEAM 2304 2301 304 2504 301
 CBEAM 2305 2301 305 2505 301
 CBEAM 2306 2301 306 2506 301
 CBEAM 2307 2301 307 2507 301
 CBEAM 2308 2301 308 2508 301
 CBEAM 2309 2301 309 2509 301
 CBEAM 2310 2301 310 2510 301
 CBEAM 2311 2301 311 2511 301
 \$
 \$ RIGHT SIDE BEAMS FROM H-TAIL HINGE LINE TO H-TAIL TRAILING EDGE
 CBEAM 2321 2301 2501 2301 2502
 CBEAM 2322 2301 2502 2302 2501
 CBEAM 2323 2301 2503 2303 2501
 CBEAM 2324 2301 2504 2304 2501
 CBEAM 2325 2301 2505 2305 2501
 CBEAM 2326 2301 2506 2306 2501
 CBEAM 2327 2301 2507 2307 2501
 CBEAM 2328 2301 2508 2308 2501
 CBEAM 2329 2301 2509 2309 2501
 CBEAM 2330 2301 2510 2310 2501
 CBEAM 2331 2301 2511 2311 2501
 \$ RIGHT SIDE BEAMS FROM V-TAIL MAIN BEAM TO HINGE LINE
 CBEAM 2401 2401 401 2601 402
 CBEAM 2402 2401 402 2602 401
 CBEAM 2403 2401 403 2603 401
 CBEAM 2404 2401 404 2604 401
 CBEAM 2405 2401 405 2605 401
 CBEAM 2406 2401 406 2606 401
 CBEAM 2407 2401 407 2607 401
 CBEAM 2408 2401 408 2608 401
 CBEAM 2409 2401 409 2609 401
 CBEAM 2410 2401 410 2610 401
 CBEAM 2411 2401 411 2611 401
 \$
 \$ RIGHT SIDE BEAMS FROM V-TAIL HINGE LINE TO V-TAIL TRAILING EDGE
 CBEAM 2421 2401 2601 2401 2602
 CBEAM 2422 2401 2602 2402 2601
 CBEAM 2423 2401 2603 2403 2601
 CBEAM 2424 2401 2604 2404 2601
 CBEAM 2425 2401 2605 2405 2601
 CBEAM 2426 2401 2606 2406 2601
 CBEAM 2427 2401 2607 2407 2601
 CBEAM 2428 2401 2608 2408 2601
 CBEAM 2429 2401 2609 2409 2601
 CBEAM 2430 2401 2610 2410 2601
 CBEAM 2431 2401 2611 2411 2601
 \$
 ENDDATA

APPENDIX B

MSC/NASTRAN file used in the flutter analysis of the semi-span model

```
$ TO EXECUTE THIS FILE USE THE FOLLOWING:
$ NASTRAN FL01 SCRATCH=YES MEM=8MW NEWS=NO
$
$ SOL 103 $ NORMAL MODES
$ SOL 144 $ STATIC AEROELASTICITY
SOL 145 $ FLUTTER SOLUTION
$ DIAG = 8,15 $ Matrix and Table trailers
TIME 30.00 $ time in minutes
$
CEND
$ TITLE = SYMMETRIC TRIM * MACH=0 * VEL=1000 IN/SEC AT SEA LEVEL
TITLE = SYMM. FREE-FREE FLUTTER * SEMISPAN MODEL * FULL FUEL
SUBTITLE = CHORDWISE GRIDS * SURFACE SPLINES
METHOD = 1
FMETHOD = 30 $ ID of FLUTTER Bulk Data entry
ECHO = UNSORT
$ ECHO = NONE
$ MODE SHAPE OUTPUT REQUESTED FOR VELOCITY=880 IN/SEC (FLFACT 4)
TRIM = 1 $ TRIM VARIABLE CONSTRAINTS
DISPLACEMENT = ALL
APRES = ALL $ PRINT AERO. PRESSURES (ONLY IN SOL 144)
AEROF = ALL $ AERO. LOADS ON AERO. CONTROL POINTS (NOT IN SOL 145)
SPC = 1 $ BOUNDARY CONDITION CONSTRAINTS
$
BEGIN BULK
$
$ LENGTH UNITS ARE INCHES, MASS UNITS ARE POUNDS
$
PARAM, POST, -2 $ IDEAS POST-PROCESSING
SUPOUT, 101, 135 $ REACTIONS FOR RIGID BODY MOTION
$
PARAM, OPPHIPA, 1 $ OUTPUT MODES AT ALL D.O.F. INCLUDING AERO D.O.F.
$
PARAM, LMODES, 10 $ USE THE 10 LOWEST NORMAL MODES
$ PARAM, VREF, 20.2537 $ CONVERT FROM IN/SEC TO KNOTS
PARAM, VREF, 12.0 $ USE VELOCITY UNITS OF FEET/SECOND
PARAM, AUNITS, 0.002588 $ ALLOWS ACCELERATION UNITS IN G'S IN TRIM ENTRY
$
$ changes "weight" input data to "mass" data
PARAM,WTMASS,0.002588
$
$ requests mass properties summary
PARAM,GRDPNT,0
$
$ DEFINE LOCAL COORDINATE SYSTEMS FOR HORIZONTAL AND VERTICAL TAILS
SPC1, 1, 123456, 30, 40 $ GRIDS 30 AND 40 ONLY USED FOR ORIENTATION
GRID, 30, 0, 379.75, 521.5678, 100.0 $ DEFINES DIRECTION OF Z-AXIS (H-TAIL)
GRID, 40, 0, 410.39, 587.3362, 100.0 $ DEFINES DIRECTION OF Z-AXIS (V-TAIL)
$
$ COORDINATE SYSTEM 12 IS A REFERENCE AXIS SYSTEM FOR STABILITY DERIVATIVES
CORD2R 12 0 156.51 0.0 48.98 156.51 0.0 40.0 +CO12
+CO12 140.0 0.0 48.98
$ LOCAL COORD. SYSTEM FOR HORIZONTAL TAIL
CORD1R, 5, 301, 30, 2301 $ Z-AXIS NORMAL TO PLANE OF HORIZ. TAIL
$ LOCAL COORD. SYSTEM FOR VERTICAL TAIL
CORD1R, 6, 401, 40, 2401 $ Z-AXIS NORMAL TO PLANE OF VERT. TAIL
$
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$ LOCAL COORDINATE SYSTEM TO DEFINE Y-AXIS OF RIGHT H-TAIL HINGE LINE
CORD2R      13      0 404.480 525.50 77.360 404.480521.5678 100.0 +CO13
+CO13      450.0531.888378.46955
$ LOCAL COORDINATE SYSTEM TO DEFINE Y-AXIS OF RIGHT V-TAIL HINGE LINE
CORD2R      14      0 433.14 496.50 157.190 433.140614.1537 200.0 +CO14
+CO14      500.0497.3168154.9451
$
CORD2C      1      0      0.      0.      0.      0.      0.      1.+FEMAPC1
+FEMAPC1    1.      0.      1.
CORD2S      2      0      0.      0.      0.      0.      0.      1.+FEMAPC2
+FEMAPC2    1.      0.      1.
$
$ SELECT THE DESIRED BOUNDARY CONDITIONS
$ Fixed Root
$ SPC      1      101 123456      0.
$
$ Symmetric BC
$ SPC      1      101 246      0.
$
$ Antisymmetric BC
$ SPC      1      101 135      0.
$
$ *****
$ SECTION FOR STATIC AEROELASTIC ANALYSIS
$ *****
$
$ CONSTRAINTS FOR AERODYNAMIC TRIM VARIABLES
$ MACH=0.0 , VELOCITY=1000.0 IN/SEC , SEA-LEVEL
$ SYMMETRIC B.C. FOR STATIC STABILITY ANALYSIS
$ SPC      1      101 1246      0.
$
$ TRIM      1      0.0      0.05734 PITCH      0.0      URDD3 -1.0      +TR01
+TR01      URDD5 0.0
$
AESTAT      70      ANGLEA
AESTAT      71      PITCH
AESTAT      73      URDD3
AESTAT      74      URDD5
$
AEROS      0      12      54.03 1236.0 31608.0 1      0
$
AESURF      80      HTAIL 13      90
AELIST      90      31001 THRU 31040
$ AESURF      81      VTAIL 14      91
$ AELIST      91      41001 THRU 41040
$
$ *****
$ END OF SECTION FOR STATIC AEROELASTIC ANALYSIS
$ *****
$
$ *****
$ BEGIN AERODYNAMIC FLUTTER CARDS
$ *****
$
$ VALUE OF FIELD 6 (SYMZX) IS 1 FOR SYM CASE, -1 FOR ASYM, 0 FOR FIXED
$ 2      3      4      5      6      7      8      9      1
$ AERO. DENSITY UNITS: LB-SEC**2/IN**4 (SEA-LEVEL)
AERO      0      0      54.03 1.145-7 1      0
$
$ Inboard Wing (RIGHT SIDE)
CAERO1 10001 1      0      17      8      1      +CA101
+CA101 132.83 0.0      48.98 59.2 134.33 223.5 60.77 54.03
$

```

```

$GRID 101 0 156.51 0.00 48.98
$ (156.51-132.83)/59.2=0.40 chord
$
$ Outboard Wing (RIGHT SIDE)
CAERO1 20001 1 0 23 8 1 +CA102
+CA102 134.33 223.5 60.77 54.03 138.03 525.5 76.79 41.28
$
$GRID 118 0 155.94 223.50 60.77
$ (155.94-134.33)/54.03=0.40 chord
$
$ RIGHT-SIDE HORIZONTAL TAIL - Corrected a touch (tip 2)
$ THE H-TAIL PANEL SPANS THE AREA FROM THE LEADING EDGE TO THE HINGE LINE
CAERO1 30001 1 0 20 8 1 +CA103
+CA103 355.08 525.5 77.36 49.40 366.04 620.5 93.92 24.704
$
$ RIGHT-SIDE CONTROL SURFACE PANEL ON HORIZONTAL TAIL
CAERO1 31001 1 0 20 2 1 +CA103A
+CA103A 404.480 525.50 77.360 12.35 390.744 620.50 93.920 6.176
$
$GRID 301 0 379.75 525.50 77.36
$ (379.75-355.08)/61.75=0.40 chord
$
$ RIGHT-SIDE VERTICAL TAIL - Corrected a bunch (Both x's and both chord lengths)
$ CAERO1 40001 1 0 16 8 1 +CA104
$ +CA104 390.67 525.5 77.5 49.3 407.54 496.5 157.19 32.00
$
$ REDEFINE POINTS 1 AND 4 FOR VERTICAL TAIL (SWAP POINTS 1 AND 4)
CAERO1 40001 1 0 20 8 1 +CA104
+CA104 407.54 496.5 157.19 25.60 390.67 525.5 77.5 39.44
$
$ RIGHT-SIDE CONTROL SURFACE PANEL ON VERTICAL TAIL
CAERO1 41001 1 0 20 2 1 +CA104A
+CA104A 433.140 496.50 157.190 6.40 430.110 525.50 77.50 9.86
$
$GRID 401 0 410.39 525.50 77.50
$ (410.39-390.67)/49.30=0.40 chord
$
$ DENS MACH VEL INTERP MODES PK TOL (0.001 default)
FLUTTER 30 PK 1 2 4 L 10
FLFACT 1 1.0
FLFACT 2 0.0
$
$ FLFACT 4 200.0 THRU 10000. 20
$ FOR PK METHOD, 'FLFACT 4' IS A VELOCITY TABLE (UNITS IN/SEC)
$ A MINUS SIGN FOR A VELOCITY IS A REQUEST FOR EIGENVALUE OUTPUT
FLFACT 4 176.0 528.0 -880.0 1320.0 1760.0 2640.0 3520.0 +FL01
+FL01 4400.0 5280.0 6200.0 7040.0
$
$ 2 3 4 5 6 7 8 9 1
$
MKAERO1 0.0 +MK1
+MK1 .0001 .01 .05 .1 .2 .5 1.0 4.0
$
PAERO1 1
$
$ TEST USAGE OF SURFACE SPLINES ON ALL LIFTING SURFACES
$ SPLINE1 = 100 RIGHT-SIDE INBOARD WING
$ SPLINE1 = 200 RIGHT-SIDE OUTBOARD WING
$ SPLINE1 = 300 RIGHT-SIDE HORIZONTAL TAIL WITHOUT CONTROL SURFACE
$ SPLINE1 = 305 RIGHT-SIDE CONTROL SURFACE ON HORIZONTAL TAIL
$ SPLINE1 = 400 RIGHT-SIDE VERTICAL TAIL WITHOUT CONTROL SURFACE
$ SPLINE1 = 405 RIGHT-SIDE CONTROL SURFACE ON VERTICAL TAIL
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SPLINE1 100      10001  10001  10136  100
SPLINE1 200      20001  20001  20184  200
$
SPLINE1 300      30001  30001  30160  300
SPLINE1 400      40001  40001  40160  400
$
SPLINE1 305      31001  31001  31040  305
SPLINE1 405      41001  41001  41040  405
$
$ GRIDS UTILIZED FOR RIGHT SIDE INBOARD WING SURFACE SPLINES
SET1      100      101      102      103      104      105      106      107+IW01
+IW01     108      109      110      111      112      113      114      115+IW02
+IW02     116      117      118      1101     1102     1103     1104     1105+IW03
+IW03     1106     1107     1108     1109     1110     1111     1112     1113+IW04
+IW04     1114     1115     1116     1117     1118     2101     2102     2103+IW05
+IW05     2104     2105     2106     2107     2108     2109     2110     2111+IW06
+IW06     2112     2113     2114     2115     2116     2117     2118
$ GRIDS UTILIZED FOR RIGHT SIDE OUTBOARD WING SURFACE SPLINES
SET1      200      118      119      120      121      122      123      124+OW01
+OW01     125      126      127      128      129      130      131      132+OW02
+OW02     133      134      135      136      137      138      139      140+OW03
+OW03     141      1118     1119     1120     1121     1122     1123     1124+OW04
+OW04     1125     1126     1127     1128     1129     1130     1131     1132+OW05
+OW05     1133     1134     1135     1136     1137     1138     1139     1140+OW06
+OW06     1141     2118     2119     2120     2121     2122     2123     2124+OW07
+OW07     2125     2126     2127     2128     2129     2130     2131     2132+OW08
+OW08     2133     2134     2135     2136     2137     2138     2139     2140+OW09
+OW09     2141
$ GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON H-TAIL
SET1      300      301      302      303      304      305      306      307+HT01
+HT01     308      309      310      311      1301     1302     1303     1304+HT02
+HT02     1305     1306     1307     1308     1309     1310     1311     2501+HT03
+HT03     2502     2503     2504     2505     2506     2507     2508     2509+HT04
+HT04     2510     2511
$ GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON H-TAIL CONTROL SURFACE
SET1      305      2501     2502     2503     2504     2505     2506     2507+HC01
+HC01     2508     2509     2510     2511     2301     2302     2303     2304+HC02
+HC02     2305     2306     2307     2308     2309     2310     2311
$ GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON V-TAIL
SET1      400      401      402      403      404      405      406      407+VT01
+VT01     408      409      410      411      1401     1402     1403     1404+VT02
+VT02     1405     1406     1407     1408     1409     1410     1411     2601+VT03
+VT03     2602     2603     2604     2605     2606     2607     2608     2609+VT04
+VT04     2610     2611
$ GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON V-TAIL CONTROL SURFACE
SET1      405      2601     2602     2603     2604     2605     2606     2607+VC01
+VC01     2608     2609     2610     2611     2401     2402     2403     2404+VC02
+VC02     2405     2406     2407     2408     2409     2410     2411
$
$ ***** END OF AERODYNAMIC FLUTTER INPUTS *****
$
EIGR      1      MGIV      10
$
$ EIGRL      1      10      0
$
$ BEAM PROPERTIES FOR RIGHT WING ELASTIC AXIS
PBEAM     101      1      1000.  1021.  247.3      0.  174.3      0.
PBEAM     102      1      1000.  1005.  227.7      0.  171.5      0.
PBEAM     103      1      1000.  989.3  208.8      0.  168.7      0.
PBEAM     104      1      1000.  974.  190.5      0.  166.  0.
PBEAM     105      1      1000.  958.7  173.  0.  163.3      0.
PBEAM     106      1      1000.  943.7  156.2      0.  160.6      0.
PBEAM     107      1      1000.  928.8  140.2      0.  157.9      0.

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PBEAM	108	1	1000.	914.	124.8	0.	155.3	0.
PBEAM	109	1	1000.	899.4	110.3	0.	152.7	0.
PBEAM	110	1	1000.	885.	96.95	0.	150.1	0.
PBEAM	111	1	1000.	870.7	92.06	0.	147.6	0.
PBEAM	112	1	1000.	856.6	86.48	0.	145.1	0.
PBEAM	113	1	1000.	842.6	79.99	0.	142.6	0.
PBEAM	114	1	1000.	828.8	75.44	0.	140.1	0.
PBEAM	115	1	1000.	815.2	71.21	0.	137.7	0.
PBEAM	116	1	1000.	801.6	68.65	0.	135.3	0.
PBEAM	117	1	1000.	788.3	67.96	0.	133.	0.
PBEAM	118	1	1000.	769.7	66.91	0.	129.7	0.
PBEAM	119	1	1000.	746.1	65.52	0.	125.5	0.
PBEAM	120	1	1000.	723.1	64.11	0.	121.4	0.
PBEAM	121	1	1000.	700.5	62.75	0.	117.4	0.
PBEAM	122	1	1000.	678.4	61.39	0.	113.5	0.
PBEAM	123	1	1000.	656.7	60.02	0.	109.7	0.
PBEAM	124	1	1000.	635.5	58.67	0.	106.	0.
PBEAM	125	1	1000.	614.8	57.33	0.	102.3	0.
PBEAM	126	1	1000.	594.6	56.01	0.	98.78	0.
PBEAM	127	1	1000.	574.8	54.7	0.	95.3	0.
PBEAM	128	1	1000.	555.4	53.4	0.	91.91	0.
PBEAM	129	1	1000.	536.5	52.12	0.	88.6	0.
PBEAM	130	1	1000.	518.	50.86	0.	85.37	0.
PBEAM	131	1	1000.	499.9	49.61	0.	82.22	0.
PBEAM	132	1	1000.	482.3	48.37	0.	79.15	0.
PBEAM	133	1	1000.	465.1	47.15	0.	76.15	0.
PBEAM	134	1	1000.	448.3	45.95	0.	73.23	0.
PBEAM	135	1	1000.	431.9	44.76	0.	70.39	0.
PBEAM	136	1	1000.	415.9	43.58	0.	67.62	0.
PBEAM	137	1	1000.	400.3	42.42	0.	64.93	0.
PBEAM	138	1	1000.	385.1	41.27	0.	62.3	0.
PBEAM	139	1	1000.	370.3	40.14	0.	59.75	0.
PBEAM	140	1	1000.	355.9	39.03	0.	57.27	0.
\$ BEAM PROPERTIES FOR RIGHT WING TIP BOOM								
PBEAM	201	2	1000.	83.46	90.29	0.	238.6	0.
PBEAM	202	2	1000.	132.9	146.5	0.	238.6	0.
PBEAM	203	2	1000.	182.3	202.8	0.	238.6	0.
PBEAM	204	2	1000.	231.8	259.1	0.	238.6	0.
PBEAM	205	2	1000.	281.2	315.3	0.	238.6	0.
PBEAM	206	2	1000.	330.7	371.6	0.	238.6	0.
PBEAM	207	2	1000.	380.1	427.8	0.	238.6	0.
PBEAM	208	2	1000.	429.5	484.1	0.	238.6	0.
PBEAM	209	2	1000.	479.	540.4	0.	238.6	0.
PBEAM	210	2	1000.	528.4	596.6	0.	238.6	0.
PBEAM	211	2	1000.	577.8	652.9	0.	238.6	0.
PBEAM	212	2	1000.	627.3	709.1	0.	238.6	0.
PBEAM	213	2	1000.	676.7	765.4	0.	238.6	0.
PBEAM	214	2	1000.	726.2	821.7	0.	238.6	0.
PBEAM	215	2	1000.	704.4	793.9	0.	238.6	0.
PBEAM	216	2	1000.	682.7	766.2	0.	238.6	0.
PBEAM	217	2	1000.	661.	738.4	0.	238.6	0.
PBEAM	218	2	1000.	639.3	710.7	0.	238.6	0.
PBEAM	219	2	1000.	597.	659.8	0.	221.1	0.
PBEAM	220	2	1000.	556.2	610.7	0.	204.5	0.
PBEAM	221	2	1000.	516.7	563.3	0.	188.8	0.
PBEAM	222	2	1000.	478.6	517.7	0.	173.9	0.
PBEAM	223	2	1000.	441.9	473.7	0.	159.8	0.
PBEAM	224	2	1000.	406.6	431.5	0.	146.5	0.
PBEAM	225	2	1000.	372.6	391.1	0.	134.	0.
PBEAM	226	2	1000.	340.	352.3	0.	122.1	0.
PBEAM	227	2	1000.	308.8	315.3	0.	111.	0.
PBEAM	228	2	1000.	278.9	279.9	0.	100.6	0.
PBEAM	229	2	1000.	253.6	249.5	0.	113.6	0.

PBEAM	230	2	1000.	226.1	217.3	0.	102.3	0.
PBEAM	231	2	1000.	200.	186.8	0.	91.71	0.
PBEAM	232	2	1000.	177.6	160.2	0.	98.27	0.
PBEAM	233	2	1000.	153.9	132.9	0.	87.36	0.
PBEAM	234	2	1000.	131.7	107.3	0.	77.29	0.
PBEAM	235	2	1000.	112.4	85.01	0.	79.37	0.
PBEAM	236	2	1000.	94.08	64.02	0.	79.38	0.
PBEAM	237	2	1000.	75.6	43.23	0.	69.04	0.
PBEAM	238	2	1000.	59.53	25.2	0.	67.1	0.
PBEAM	239	2	1000.	44.55	8.614	0.	63.92	0.
PBEAM	240	2	1000.	30.7	8.007	0.	59.78	0.
PBEAM	241	2	1000.	14.37	3.655	0.	27.47	0.
PBEAM	242	2	1000.	3.024	3.024	0.	22.9	0.
\$ BEAM PROPERTIES FOR RIGHT SIDE HORIZONTAL TAIL								
PBEAM	301	3	1000.	1047.	54.91	0.	179.	0.
PBEAM	302	3	1000.	894.1	41.7	0.	151.7	0.
PBEAM	303	3	1000.	756.8	30.83	0.	127.4	0.
PBEAM	304	3	1000.	634.3	22.05	0.	105.8	0.
PBEAM	305	3	1000.	525.8	15.11	0.	86.74	0.
PBEAM	306	3	1000.	430.5	9.772	0.	70.15	0.
PBEAM	307	3	1000.	347.4	5.823	0.	55.82	0.
PBEAM	308	3	1000.	275.8	3.046	0.	43.59	0.
PBEAM	309	3	1000.	214.8	1.241	0.	33.28	0.
PBEAM	310	3	1000.	163.5	0.2188	0.	24.75	0.
\$ BEAM PROPERTIES FOR RIGHT SIDE VERTICAL TAIL								
PBEAM	401	4	1000.	542.6	24.42	0.	73.63	0.
PBEAM	402	4	1000.	486.7	18.52	0.	66.03	0.
PBEAM	403	4	1000.	434.7	13.68	0.	58.98	0.
PBEAM	404	4	1000.	386.6	9.785	0.	52.45	0.
PBEAM	405	4	1000.	342.1	6.712	0.	46.42	0.
PBEAM	406	4	1000.	301.3	4.35	0.	40.87	0.
PBEAM	407	4	1000.	263.8	2.599	0.	35.79	0.
PBEAM	408	4	1000.	229.5	1.365	0.	31.14	0.
PBEAM	409	4	1000.	198.4	0.5584	0.	26.91	0.
PBEAM	410	4	1000.	170.2	0.09922	0.	23.09	0.
\$								
\$ FEMAP Material 1 : Generic - WING AND CHORDWISE SPINES								
MAT1	11000000.1000000.	0.3	0.	0.	0.	0.	0.	0.
\$								
\$ FEMAP Material 1 : Generic - BOOM								
MAT1	21000000.1000000.	0.3	0.	0.	0.	0.	0.	0.
\$								
\$ FEMAP Material 1 : Generic - HORIZONTAL								
MAT1	31000000.1000000.	0.3	0.	0.	0.	0.	0.	0.
\$								
\$ FEMAP Material 1 : Generic - VERTICAL								
MAT1	41000000.1000000.	0.3	0.	0.	0.	0.	0.	0.
\$								
\$ GRID 100 REPRESENTS PROPULSION SYSTEM								
RBE2	504	101	123456	100				
\$ CONNECTIONS TO WING-TIP BOOM, HORIZONTAL AND VERTICAL TAILS								
\$								
RBE2	501	141	123456	216				
RBE2	502	238	123456	301				
RBE2	503	240	123456	401				
\$								
GRID	100	0	125.8	0.0	86.1	0		
\$								
\$ GRIDS FOR RIGHT WING BEAM								
\$								
GRID	101	0	156.51	0.00	48.98	0		
GRID	102	0	156.48	13.15	49.67	0		
GRID	103	0	156.45	26.29	50.37	0		

GRID	104	0	156.41	39.44	51.06	0
GRID	105	0	156.38	52.59	51.75	0
GRID	106	0	156.34	65.74	52.45	0
GRID	107	0	156.31	78.88	53.14	0
GRID	108	0	156.28	92.03	53.83	0
GRID	109	0	156.24	105.18	54.53	0
GRID	110	0	156.21	118.32	55.22	0
GRID	111	0	156.18	131.47	55.91	0
GRID	112	0	156.14	144.62	56.61	0
GRID	113	0	156.11	157.76	57.30	0
GRID	114	0	156.08	170.91	57.99	0
GRID	115	0	156.04	184.06	58.69	0
GRID	116	0	156.01	197.21	59.38	0
GRID	117	0	155.98	210.35	60.07	0
GRID	118	0	155.94	223.50	60.77	0
GRID	119	0	155.88	236.63	61.46	0
GRID	120	0	155.82	249.76	62.16	0
GRID	121	0	155.76	262.89	62.86	0
GRID	122	0	155.70	276.02	63.55	0
GRID	123	0	155.64	289.15	64.25	0
GRID	124	0	155.58	302.28	64.95	0
GRID	125	0	155.52	315.41	65.64	0
GRID	126	0	155.46	328.54	66.34	0
GRID	127	0	155.39	341.67	67.04	0
GRID	128	0	155.33	354.80	67.73	0
GRID	129	0	155.27	367.93	68.43	0
GRID	130	0	155.21	381.07	69.13	0
GRID	131	0	155.15	394.20	69.82	0
GRID	132	0	155.09	407.33	70.52	0
GRID	133	0	155.03	420.46	71.22	0
GRID	134	0	154.97	433.59	71.91	0
GRID	135	0	154.91	446.72	72.61	0
GRID	136	0	154.85	459.85	73.31	0
GRID	137	0	154.79	472.98	74.00	0
GRID	138	0	154.72	486.11	74.70	0
GRID	139	0	154.66	499.24	75.40	0
GRID	140	0	154.60	512.37	76.09	0
GRID	141	0	154.54	525.50	76.79	0

\$

\$ RIGHT SIDE WING SURFACE LEADING-EDGE GRID POINTS

\$

GRID	1101	0	132.83	0.00	48.98	0
GRID	1102	0	132.92	13.15	49.67	0
GRID	1103	0	133.01	26.29	50.37	0
GRID	1104	0	133.10	39.44	51.06	0
GRID	1105	0	133.18	52.59	51.75	0
GRID	1106	0	133.27	65.74	52.45	0
GRID	1107	0	133.36	78.88	53.14	0
GRID	1108	0	133.45	92.03	53.83	0
GRID	1109	0	133.54	105.18	54.53	0
GRID	1110	0	133.63	118.32	55.22	0
GRID	1111	0	133.71	131.47	55.91	0
GRID	1112	0	133.80	144.62	56.61	0
GRID	1113	0	133.89	157.76	57.30	0
GRID	1114	0	133.98	170.91	57.99	0
GRID	1115	0	134.07	184.06	58.69	0
GRID	1116	0	134.16	197.21	59.38	0
GRID	1117	0	134.24	210.35	60.07	0
GRID	1118	0	134.33	223.50	60.77	0
GRID	1119	0	134.49	236.63	61.46	0
GRID	1120	0	134.65	249.76	62.16	0
GRID	1121	0	134.81	262.89	62.86	0
GRID	1122	0	134.97	276.02	63.55	0

GRID	1123	0	135.14	289.15	64.25	0
GRID	1124	0	135.30	302.28	64.95	0
GRID	1125	0	135.46	315.41	65.64	0
GRID	1126	0	135.62	328.54	66.34	0
GRID	1127	0	135.78	341.67	67.04	0
GRID	1128	0	135.94	354.80	67.73	0
GRID	1129	0	136.10	367.93	68.43	0
GRID	1130	0	136.26	381.07	69.13	0
GRID	1131	0	136.42	394.20	69.82	0
GRID	1132	0	136.58	407.33	70.52	0
GRID	1133	0	136.74	420.46	71.22	0
GRID	1134	0	136.90	433.59	71.91	0
GRID	1135	0	137.06	446.72	72.61	0
GRID	1136	0	137.22	459.85	73.31	0
GRID	1137	0	137.38	472.98	74.00	0
GRID	1138	0	137.55	486.11	74.70	0
GRID	1139	0	137.71	499.24	75.40	0
GRID	1140	0	137.87	512.37	76.09	0
GRID	1141	0	138.03	525.50	76.79	0

\$

\$ RIGHT SIDE WING SURFACE TRAILING-EDGE GRID POINTS

\$

GRID	2101	0	192.03	0.00	48.98	0
GRID	2102	0	191.82	13.15	49.67	0
GRID	2103	0	191.60	26.29	50.37	0
GRID	2104	0	191.39	39.44	51.06	0
GRID	2105	0	191.17	52.59	51.75	0
GRID	2106	0	190.95	65.74	52.45	0
GRID	2107	0	190.74	78.88	53.14	0
GRID	2108	0	190.52	92.03	53.83	0
GRID	2109	0	190.30	105.18	54.53	0
GRID	2110	0	190.09	118.32	55.22	0
GRID	2111	0	189.87	131.47	55.91	0
GRID	2112	0	189.66	144.62	56.61	0
GRID	2113	0	189.44	157.76	57.30	0
GRID	2114	0	189.22	170.91	57.99	0
GRID	2115	0	189.01	184.06	58.69	0
GRID	2116	0	188.79	197.21	59.38	0
GRID	2117	0	188.58	210.35	60.07	0
GRID	2118	0	188.36	223.50	60.77	0
GRID	2119	0	187.97	236.63	61.46	0
GRID	2120	0	187.57	249.76	62.16	0
GRID	2121	0	187.18	262.89	62.86	0
GRID	2122	0	186.79	276.02	63.55	0
GRID	2123	0	186.39	289.15	64.25	0
GRID	2124	0	186.00	302.28	64.95	0
GRID	2125	0	185.61	315.41	65.64	0
GRID	2126	0	185.21	328.54	66.34	0
GRID	2127	0	184.82	341.67	67.04	0
GRID	2128	0	184.43	354.80	67.73	0
GRID	2129	0	184.03	367.93	68.43	0
GRID	2130	0	183.64	381.07	69.13	0
GRID	2131	0	183.25	394.20	69.82	0
GRID	2132	0	182.85	407.33	70.52	0
GRID	2133	0	182.46	420.46	71.22	0
GRID	2134	0	182.07	433.59	71.91	0
GRID	2135	0	181.67	446.72	72.61	0
GRID	2136	0	181.28	459.85	73.31	0
GRID	2137	0	180.89	472.98	74.00	0
GRID	2138	0	180.49	486.11	74.70	0
GRID	2139	0	180.10	499.24	75.40	0
GRID	2140	0	179.71	512.37	76.09	0
GRID	2141	0	179.31	525.50	76.79	0

\$
 \$ RIGHT WING * LEADING AND TRAILING EDGE GRIDS ARE DEPENDENT ON MAIN BEAM
 \$

RBE2	1201	101	123456	1101	2101
RBE2	1202	102	123456	1102	2102
RBE2	1203	103	123456	1103	2103
RBE2	1204	104	123456	1104	2104
RBE2	1205	105	123456	1105	2105
RBE2	1206	106	123456	1106	2106
RBE2	1207	107	123456	1107	2107
RBE2	1208	108	123456	1108	2108
RBE2	1209	109	123456	1109	2109
RBE2	1210	110	123456	1110	2110
RBE2	1211	111	123456	1111	2111
RBE2	1212	112	123456	1112	2112
RBE2	1213	113	123456	1113	2113
RBE2	1214	114	123456	1114	2114
RBE2	1215	115	123456	1115	2115
RBE2	1216	116	123456	1116	2116
RBE2	1217	117	123456	1117	2117
RBE2	1218	118	123456	1118	2118
RBE2	1219	119	123456	1119	2119
RBE2	1220	120	123456	1120	2120
RBE2	1221	121	123456	1121	2121
RBE2	1222	122	123456	1122	2122
RBE2	1223	123	123456	1123	2123
RBE2	1224	124	123456	1124	2124
RBE2	1225	125	123456	1125	2125
RBE2	1226	126	123456	1126	2126
RBE2	1227	127	123456	1127	2127
RBE2	1228	128	123456	1128	2128
RBE2	1229	129	123456	1129	2129
RBE2	1230	130	123456	1130	2130
RBE2	1231	131	123456	1131	2131
RBE2	1232	132	123456	1132	2132
RBE2	1233	133	123456	1133	2133
RBE2	1234	134	123456	1134	2134
RBE2	1235	135	123456	1135	2135
RBE2	1236	136	123456	1136	2136
RBE2	1237	137	123456	1137	2137
RBE2	1238	138	123456	1138	2138
RBE2	1239	139	123456	1139	2139
RBE2	1240	140	123456	1140	2140
RBE2	1241	141	123456	1141	2141

\$
 \$ GRIDS FOR RIGHT SIDE WING-TIP BOOM
 \$

GRID	201	0	25.	525.5	77.5	0
GRID	202	0	33.6111	525.5	77.5	0
GRID	203	0	42.2222	525.5	77.5	0
GRID	204	0	50.8333	525.5	77.5	0
GRID	205	0	59.4444	525.5	77.5	0
GRID	206	0	68.0556	525.5	77.5	0
GRID	207	0	76.6667	525.5	77.5	0
GRID	208	0	85.2778	525.5	77.5	0
GRID	209	0	93.8889	525.5	77.5	0
GRID	210	0	102.5	525.5	77.5	0
GRID	211	0	111.111	525.5	77.5	0
GRID	212	0	119.722	525.5	77.5	0
GRID	213	0	128.333	525.5	77.5	0
GRID	214	0	136.944	525.5	77.5	0
GRID	215	0	145.556	525.5	77.5	0
GRID	216	0	154.167	525.5	77.5	0

GRID	217	0	162.778	525.5	77.5	0
GRID	218	0	171.389	525.5	77.5	0
GRID	219	0	180.	525.5	77.5	0
GRID	220	0	190.	525.5	77.5	0
GRID	221	0	200.	525.5	77.5	0
GRID	222	0	210.	525.5	77.5	0
GRID	223	0	220.	525.5	77.5	0
GRID	224	0	230.	525.5	77.5	0
GRID	225	0	240.	525.5	77.5	0
GRID	226	0	250.	525.5	77.5	0
GRID	227	0	260.	525.5	77.5	0
GRID	228	0	270.	525.5	77.5	0
GRID	229	0	280.	525.5	77.5	0
GRID	230	0	290.	525.5	77.5	0
GRID	231	0	300.	525.5	77.5	0
GRID	232	0	310.	525.5	77.5	0
GRID	233	0	320.	525.5	77.5	0
GRID	234	0	330.	525.5	77.5	0
GRID	235	0	340.	525.5	77.5	0
GRID	236	0	350.	525.5	77.5	0
GRID	237	0	360.	525.5	77.5	0
GRID	238	0	370.	525.5	77.5	0
GRID	239	0	380.	525.5	77.5	0
GRID	240	0	390.	525.5	77.5	0
GRID	241	0	400.	525.5	77.5	0
GRID	242	0	410.	525.5	77.5	0
GRID	243	0	420.	525.5	77.5	0

\$

\$ *****

\$ RIGHT SIDE HORIZONTAL TAIL DEFINITION

\$ *****

\$ GRIDS FOR RIGHT SIDE HORIZONTAL TAIL BEAM

\$

GRID	301	0	379.75	525.50	77.36	0
GRID	302	0	379.61	535.00	79.01	0
GRID	303	0	379.47	544.50	80.67	0
GRID	304	0	379.34	554.00	82.33	0
GRID	305	0	379.20	563.50	83.98	0
GRID	306	0	379.06	573.00	85.64	0
GRID	307	0	378.92	582.50	87.30	0
GRID	308	0	378.79	592.00	88.95	0
GRID	309	0	378.65	601.50	90.61	0
GRID	310	0	378.51	611.00	92.27	0
GRID	311	0	378.37	620.50	93.92	0

\$ DUPLICATE GRIDS FOR HORIZONTAL TAIL MAIN BEAM

\$ THE OUTPUT OF THESE GRIDS WILL BE IN COORD. SYST. 5

GRID	331	0	379.75	525.50	77.36	5
GRID	332	0	379.61	535.00	79.01	5
GRID	333	0	379.47	544.50	80.67	5
GRID	334	0	379.34	554.00	82.33	5
GRID	335	0	379.20	563.50	83.98	5
GRID	336	0	379.06	573.00	85.64	5
GRID	337	0	378.92	582.50	87.30	5
GRID	338	0	378.79	592.00	88.95	5
GRID	339	0	378.65	601.50	90.61	5
GRID	340	0	378.51	611.00	92.27	5
GRID	341	0	378.37	620.50	93.92	5

\$ DUPLICATE GRIDS ON H-TAIL ARE DEPENDENT ON ELASTIC AXIS BEAM

RBE2	521	301	123456	331
RBE2	522	302	123456	332
RBE2	523	303	123456	333
RBE2	524	304	123456	334
RBE2	525	305	123456	335

RBE2	526	306	123456	336		
RBE2	527	307	123456	337		
RBE2	528	308	123456	338		
RBE2	529	309	123456	339		
RBE2	530	310	123456	340		
RBE2	531	311	123456	341		
\$						
\$ RIGHT SIDE HORIZONTAL TAIL LEADING EDGE						
\$						
GRID	1301	0	355.08	525.50	77.36	0
GRID	1302	0	356.17	535.00	79.01	0
GRID	1303	0	357.27	544.50	80.67	0
GRID	1304	0	358.36	554.00	82.33	0
GRID	1305	0	359.46	563.50	83.98	0
GRID	1306	0	360.56	573.00	85.64	0
GRID	1307	0	361.65	582.50	87.30	0
GRID	1308	0	362.75	592.00	88.95	0
GRID	1309	0	363.85	601.50	90.61	0
GRID	1310	0	364.94	611.00	92.27	0
GRID	1311	0	366.04	620.50	93.92	0
\$						
\$ DISPLACEMENT OF H-TAIL L.E. IS DEPENDENT ON ELASTIC AXIS						
RBE2	1251	301	123456	1301		
RBE2	1252	302	123456	1302		
RBE2	1253	303	123456	1303		
RBE2	1254	304	123456	1304		
RBE2	1255	305	123456	1305		
RBE2	1256	306	123456	1306		
RBE2	1257	307	123456	1307		
RBE2	1258	308	123456	1308		
RBE2	1259	309	123456	1309		
RBE2	1260	310	123456	1310		
RBE2	1261	311	123456	1311		
\$						
\$ DUPLICATE GRIDS FOR HORIZONTAL TAIL LEADING EDGE						
\$ THE OUTPUT OF THESE GRIDS WILL BE IN COORD. SYST. 5						
GRID	1331	0	355.08	525.50	77.36	5
GRID	1332	0	356.17	535.00	79.01	5
GRID	1333	0	357.27	544.50	80.67	5
GRID	1334	0	358.36	554.00	82.33	5
GRID	1335	0	359.46	563.50	83.98	5
GRID	1336	0	360.56	573.00	85.64	5
GRID	1337	0	361.65	582.50	87.30	5
GRID	1338	0	362.75	592.00	88.95	5
GRID	1339	0	363.85	601.50	90.61	5
GRID	1340	0	364.94	611.00	92.27	5
GRID	1341	0	366.04	620.50	93.92	5
\$						
\$ DUPLICATE GRIDS ON H-TAIL LEADING EDGE ARE DEPENDENT ON ELASTIC AXIS						
RBE2	541	301	123456	1331		
RBE2	542	302	123456	1332		
RBE2	543	303	123456	1333		
RBE2	544	304	123456	1334		
RBE2	545	305	123456	1335		
RBE2	546	306	123456	1336		
RBE2	547	307	123456	1337		
RBE2	548	308	123456	1338		
RBE2	549	309	123456	1339		
RBE2	550	310	123456	1340		
RBE2	551	311	123456	1341		
\$						
\$ RIGHT SIDE HORIZONTAL TAIL TRAILING EDGE						
\$						
GRID	2301	0	416.83	525.50	77.36	0

GRID	2302	0	414.84	535.00	79.01	0
GRID	2303	0	412.85	544.50	80.67	0
GRID	2304	0	410.86	554.00	82.33	0
GRID	2305	0	408.87	563.50	83.98	0
GRID	2306	0	406.88	573.00	85.64	0
GRID	2307	0	404.88	582.50	87.30	0
GRID	2308	0	402.89	592.00	88.95	0
GRID	2309	0	400.90	601.50	90.61	0
GRID	2310	0	398.91	611.00	92.27	0
GRID	2311	0	396.92	620.50	93.92	0

\$ DUPLICATE GRIDS FOR HORIZONTAL TAIL TRAILING EDGE

\$ THE OUTPUT FOR THESE GRIDS WILL BE IN COORD. SYST. 5

GRID	2331	0	416.83	525.50	77.36	5
GRID	2332	0	414.84	535.00	79.01	5
GRID	2333	0	412.85	544.50	80.67	5
GRID	2334	0	410.86	554.00	82.33	5
GRID	2335	0	408.87	563.50	83.98	5
GRID	2336	0	406.88	573.00	85.64	5
GRID	2337	0	404.88	582.50	87.30	5
GRID	2338	0	402.89	592.00	88.95	5
GRID	2339	0	400.90	601.50	90.61	5
GRID	2340	0	398.91	611.00	92.27	5
GRID	2341	0	396.92	620.50	93.92	5

\$ DUPLICATE H-TAIL T.E. GRIDS ARE DEPENDENT ON ORIGINAL T.E. GRIDS

RBE2	561	2301	123456	2331
RBE2	562	2302	123456	2332
RBE2	563	2303	123456	2333
RBE2	564	2304	123456	2334
RBE2	565	2305	123456	2335
RBE2	566	2306	123456	2336
RBE2	567	2307	123456	2337
RBE2	568	2308	123456	2338
RBE2	569	2309	123456	2339
RBE2	570	2310	123456	2340
RBE2	571	2311	123456	2341

\$

\$ GRIDS AT 80% CHORD HINGE-LINE OF RIGHT SIDE HORIZONTAL TAIL

GRID	2501	0	404.480	525.500	77.360	0
GRID	2502	0	403.106	535.000	79.010	0
GRID	2503	0	401.734	544.500	80.670	0
GRID	2504	0	400.360	554.000	82.330	0
GRID	2505	0	398.988	563.500	83.980	0
GRID	2506	0	397.616	573.000	85.640	0
GRID	2507	0	396.234	582.500	87.300	0
GRID	2508	0	394.862	592.000	88.950	0
GRID	2509	0	393.490	601.500	90.610	0
GRID	2510	0	392.116	611.000	92.270	0
GRID	2511	0	390.744	620.500	93.920	0

\$

\$ *****

\$ END OF RIGHT SIDE HORIZONTAL TAIL DEFINITION

\$ *****

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\$ *****

\$ RIGHT SIDE VERTICAL TAIL DEFINITION

\$ *****

\$

\$ GRIDS FOR RIGHT SIDE VERTICAL TAIL BEAM

GRID	401	0	410.39	525.50	77.50	0
GRID	402	0	411.39	522.60	85.47	0
GRID	403	0	412.38	519.70	93.44	0
GRID	404	0	413.38	516.80	101.41	0
GRID	405	0	414.37	513.90	109.38	0

GRID	406	0	415.37	511.00	117.34	0
GRID	407	0	416.36	508.10	125.31	0
GRID	408	0	417.36	505.20	133.28	0
GRID	409	0	418.35	502.30	141.25	0
GRID	410	0	419.35	499.40	149.22	0
GRID	411	0	420.34	496.50	157.19	0
\$ THIS GROUP OF GRIDS GENERATES OUTPUT IN COORD. SYSTEM 6						
\$ THE Z-AXIS FOR COORD. SYS. 5 IS NORMAL TO PLANE OF V-TAIL						
GRID	431	0	410.39	525.50	77.50	6
GRID	432	0	411.39	522.60	85.47	6
GRID	433	0	412.38	519.70	93.44	6
GRID	434	0	413.38	516.80	101.41	6
GRID	435	0	414.37	513.90	109.38	6
GRID	436	0	415.37	511.00	117.34	6
GRID	437	0	416.36	508.10	125.31	6
GRID	438	0	417.36	505.20	133.28	6
GRID	439	0	418.35	502.30	141.25	6
GRID	440	0	419.35	499.40	149.22	6
GRID	441	0	420.34	496.50	157.19	6
\$ DUPLICATE GRIDS OF MAIN V-TAIL ARE DEPENDENT ON ELASTIC AXIS GRIDS						
RBE2	581	401	123456	431		
RBE2	582	402	123456	432		
RBE2	583	403	123456	433		
RBE2	584	404	123456	434		
RBE2	585	405	123456	435		
RBE2	586	406	123456	436		
RBE2	587	407	123456	437		
RBE2	588	408	123456	438		
RBE2	589	409	123456	439		
RBE2	590	410	123456	440		
RBE2	591	411	123456	441		
\$						
\$ RIGHT SIDE VERTICAL TAIL LEADING EDGE						
\$						
GRID	1401	0	390.67	525.50	77.50	0
GRID	1402	0	392.36	522.60	85.47	0
GRID	1403	0	394.05	519.70	93.44	0
GRID	1404	0	395.73	516.80	101.41	0
GRID	1405	0	397.42	513.90	109.38	0
GRID	1406	0	399.11	511.00	117.34	0
GRID	1407	0	400.79	508.10	125.31	0
GRID	1408	0	402.48	505.20	133.28	0
GRID	1409	0	404.17	502.30	141.25	0
GRID	1410	0	405.85	499.40	149.22	0
GRID	1411	0	407.54	496.50	157.19	0
\$						
\$ LEADING EDGE V-TAIL GRIDS ARE DEPENDENT ON ELASTIC AXIS						
RBE2	1271	401	123456	1401		
RBE2	1272	402	123456	1402		
RBE2	1273	403	123456	1403		
RBE2	1274	404	123456	1404		
RBE2	1275	405	123456	1405		
RBE2	1276	406	123456	1406		
RBE2	1277	407	123456	1407		
RBE2	1278	408	123456	1408		
RBE2	1279	409	123456	1409		
RBE2	1280	410	123456	1410		
RBE2	1281	411	123456	1411		
\$						
\$ DUPLICATE GRIDS FOR VERTICAL TAIL LEADING EDGE						
\$ THE OUTPUT OF THESE GRIDS WILL BE IN COORD. SYST. 6						
GRID	1431	0	390.67	525.50	77.50	6
GRID	1432	0	392.36	522.60	85.47	6

GRID	1433	0	394.05	519.70	93.44	6
GRID	1434	0	395.73	516.80	101.41	6
GRID	1435	0	397.42	513.90	109.38	6
GRID	1436	0	399.11	511.00	117.34	6
GRID	1437	0	400.79	508.10	125.31	6
GRID	1438	0	402.48	505.20	133.28	6
GRID	1439	0	404.17	502.30	141.25	6
GRID	1440	0	405.85	499.40	149.22	6
GRID	1441	0	407.54	496.50	157.19	6

\$ V-TAIL LEADING EDGE DUPLICATE GRIDS ARE DEPENDENT ON ELASTIC AXIS GRIDS

RBE2	601	401	123456	1431
RBE2	602	402	123456	1432
RBE2	603	403	123456	1433
RBE2	604	404	123456	1434
RBE2	605	405	123456	1435
RBE2	606	406	123456	1436
RBE2	607	407	123456	1437
RBE2	608	408	123456	1438
RBE2	609	409	123456	1439
RBE2	610	410	123456	1440
RBE2	611	411	123456	1441

\$

\$ RIGHT SIDE VERTICAL TAIL TRAILING EDGE

\$

GRID	2401	0	439.97	525.50	77.50	0
GRID	2402	0	439.93	522.60	85.47	0
GRID	2403	0	439.89	519.70	93.44	0
GRID	2404	0	439.84	516.80	101.41	0
GRID	2405	0	439.80	513.90	109.38	0
GRID	2406	0	439.76	511.00	117.34	0
GRID	2407	0	439.71	508.10	125.31	0
GRID	2408	0	439.67	505.20	133.28	0
GRID	2409	0	439.63	502.30	141.25	0
GRID	2410	0	439.58	499.40	149.22	0
GRID	2411	0	439.54	496.50	157.19	0

\$ DUPLICATE GRIDS FOR VERTICAL TAIL TRAILING EDGE

\$ THE OUTPUT FOR THESE GRIDS WILL BE IN COORD. SYST. 6

GRID	2431	0	439.97	525.50	77.50	6
GRID	2432	0	439.93	522.60	85.47	6
GRID	2433	0	439.89	519.70	93.44	6
GRID	2434	0	439.84	516.80	101.41	6
GRID	2435	0	439.80	513.90	109.38	6
GRID	2436	0	439.76	511.00	117.34	6
GRID	2437	0	439.71	508.10	125.31	6
GRID	2438	0	439.67	505.20	133.28	6
GRID	2439	0	439.63	502.30	141.25	6
GRID	2440	0	439.58	499.40	149.22	6
GRID	2441	0	439.54	496.50	157.19	6

\$ DUPLICATE V-TAIL T.E. GRIDS ARE DEPENDENT ON ORIGINAL GRIDS

RBE2	621	2401	123456	2431
RBE2	622	2402	123456	2432
RBE2	623	2403	123456	2433
RBE2	624	2404	123456	2434
RBE2	625	2405	123456	2435
RBE2	626	2406	123456	2436
RBE2	627	2407	123456	2437
RBE2	628	2408	123456	2438
RBE2	629	2409	123456	2439
RBE2	630	2410	123456	2440
RBE2	631	2411	123456	2441

\$

\$ GRIDS AT 80% CHORD HINGE-LINE OF RIGHT SIDE VERTICAL TAIL

GRID	2601	0	430.110	525.500	77.500	0
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GRID	2602	0	430.416	522.600	85.470	0
GRID	2603	0	430.722	519.700	93.440	0
GRID	2604	0	431.018	516.800	101.410	0
GRID	2605	0	431.324	513.900	109.380	0
GRID	2606	0	431.630	511.000	117.340	0
GRID	2607	0	431.926	508.100	125.310	0
GRID	2608	0	432.232	505.200	133.280	0
GRID	2609	0	432.538	502.300	141.250	0
GRID	2610	0	432.834	499.400	149.220	0
GRID	2611	0	433.140	496.500	157.190	0

\$

\$

\$

END OF RIGHT SIDE VERTICAL TAIL DEFINITION

\$

\$

\$ MAIN BEAMS FOR RIGHT WING

CBEAM	101	101	101	102	-1.	0.	0.
CBEAM	102	102	102	103	-1.	0.	0.
CBEAM	103	103	103	104	-1.	0.	0.
CBEAM	104	104	104	105	-1.	0.	0.
CBEAM	105	105	105	106	-1.	0.	0.
CBEAM	106	106	106	107	-1.	0.	0.
CBEAM	107	107	107	108	-1.	0.	0.
CBEAM	108	108	108	109	-1.	0.	0.
CBEAM	109	109	109	110	-1.	0.	0.
CBEAM	110	110	110	111	-1.	0.	0.
CBEAM	111	111	111	112	-1.	0.	0.
CBEAM	112	112	112	113	-1.	0.	0.
CBEAM	113	113	113	114	-1.	0.	0.
CBEAM	114	114	114	115	-1.	0.	0.
CBEAM	115	115	115	116	-1.	0.	0.
CBEAM	116	116	116	117	-1.	0.	0.
CBEAM	117	117	117	118	-1.	0.	0.
CBEAM	118	118	118	119	-1.	0.	0.
CBEAM	119	119	119	120	-1.	0.	0.
CBEAM	120	120	120	121	-1.	0.	0.
CBEAM	121	121	121	122	-1.	0.	0.
CBEAM	122	122	122	123	-1.	0.	0.
CBEAM	123	123	123	124	-1.	0.	0.
CBEAM	124	124	124	125	-1.	0.	0.
CBEAM	125	125	125	126	-1.	0.	0.
CBEAM	126	126	126	127	-1.	0.	0.
CBEAM	127	127	127	128	-1.	0.	0.
CBEAM	128	128	128	129	-1.	0.	0.
CBEAM	129	129	129	130	-1.	0.	0.
CBEAM	130	130	130	131	-1.	0.	0.
CBEAM	131	131	131	132	-1.	0.	0.
CBEAM	132	132	132	133	-1.	0.	0.
CBEAM	133	133	133	134	-1.	0.	0.
CBEAM	134	134	134	135	-1.	0.	0.
CBEAM	135	135	135	136	-1.	0.	0.
CBEAM	136	136	136	137	-1.	0.	0.
CBEAM	137	137	137	138	-1.	0.	0.
CBEAM	138	138	138	139	-1.	0.	0.
CBEAM	139	139	139	140	-1.	0.	0.
CBEAM	140	140	140	141	-1.	0.	0.

\$ BEAMS FOR RIGHT WING TIP BOOM

CBEAM	201	201	201	202	0.	1.	0.
CBEAM	202	202	202	203	0.	1.	0.
CBEAM	203	203	203	204	0.	1.	0.
CBEAM	204	204	204	205	0.	1.	0.
CBEAM	205	205	205	206	0.	1.	0.
CBEAM	206	206	206	207	0.	1.	0.

CBEAM	207	207	207	208	0.	1.	0.
CBEAM	208	208	208	209	0.	1.	0.
CBEAM	209	209	209	210	0.	1.	0.
CBEAM	210	210	210	211	0.	1.	0.
CBEAM	211	211	211	212	0.	1.	0.
CBEAM	212	212	212	213	0.	1.	0.
CBEAM	213	213	213	214	0.	1.	0.
CBEAM	214	214	214	215	0.	1.	0.
CBEAM	215	215	215	216	0.	1.	0.
CBEAM	216	216	216	217	0.	1.	0.
CBEAM	217	217	217	218	0.	1.	0.
CBEAM	218	218	218	219	0.	1.	0.
CBEAM	219	219	219	220	0.	1.	0.
CBEAM	220	220	220	221	0.	1.	0.
CBEAM	221	221	221	222	0.	1.	0.
CBEAM	222	222	222	223	0.	1.	0.
CBEAM	223	223	223	224	0.	1.	0.
CBEAM	224	224	224	225	0.	1.	0.
CBEAM	225	225	225	226	0.	1.	0.
CBEAM	226	226	226	227	0.	1.	0.
CBEAM	227	227	227	228	0.	1.	0.
CBEAM	228	228	228	229	0.	1.	0.
CBEAM	229	229	229	230	0.	1.	0.
CBEAM	230	230	230	231	0.	1.	0.
CBEAM	231	231	231	232	0.	1.	0.
CBEAM	232	232	232	233	0.	1.	0.
CBEAM	233	233	233	234	0.	1.	0.
CBEAM	234	234	234	235	0.	1.	0.
CBEAM	235	235	235	236	0.	1.	0.
CBEAM	236	236	236	237	0.	1.	0.
CBEAM	237	237	237	238	0.	1.	0.
CBEAM	238	238	238	239	0.	1.	0.
CBEAM	239	239	239	240	0.	1.	0.
CBEAM	240	240	240	241	0.	1.	0.
CBEAM	241	241	241	242	0.	1.	0.
CBEAM	242	242	242	243	0.	1.	0.

\$ RIGHT SIDE HORIZONTAL TAIL BEAMS

CBEAM	301	301	301	302	-1.	0.	0.
CBEAM	302	302	302	303	-1.	0.	0.
CBEAM	303	303	303	304	-1.	0.	0.
CBEAM	304	304	304	305	-1.	0.	0.
CBEAM	305	305	305	306	-1.	0.	0.
CBEAM	306	306	306	307	-1.	0.	0.
CBEAM	307	307	307	308	-1.	0.	0.
CBEAM	308	308	308	309	-1.	0.	0.
CBEAM	309	309	309	310	-1.	0.	0.
CBEAM	310	310	310	311	-1.	0.	0.

\$ RIGHT SIDE VERTICAL TAIL BEAMS

CBEAM	401	401	401	402	1.	0.	0.
CBEAM	402	402	402	403	1.	0.	0.
CBEAM	403	403	403	404	1.	0.	0.
CBEAM	404	404	404	405	1.	0.	0.
CBEAM	405	405	405	406	1.	0.	0.
CBEAM	406	406	406	407	1.	0.	0.
CBEAM	407	407	407	408	1.	0.	0.
CBEAM	408	408	408	409	1.	0.	0.
CBEAM	409	409	409	410	1.	0.	0.
CBEAM	410	410	410	411	1.	0.	0.

\$

\$ Fuselage Rigid Body Mass (50% for 1/2 symm model)

\$

CONM2	601	100	-1	446.1	125.80	0.00	86.1	0 MASS601
+MASS601	2.64E5	0	8.90E5	0	0	6.95E5		

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$
$ *****
$ LUMPED MASSES FOR RIGHT-WING
$ *****
$ RIGHT WING
CONM2      602      102      -1      7.91  157.54      6.57  49.16      0 MASS602
CONM2      603      103      -1      7.75  157.67      19.72  49.83      0 MASS603
CONM2      604      104      -1      7.60  157.80      32.87  50.50      0 MASS604
CONM2      605      105      -1      7.45  157.92      46.01  51.17      0 MASS605
CONM2      606      106      -1      7.30  158.05      59.16  51.84      0 MASS606
CONM2      607      107      -1      7.16  158.17      72.31  52.51      0 MASS607
CONM2      608      108      -1      7.03  158.30      85.46  53.17      0 MASS608
CONM2      609      109      -1      6.90  158.42      98.60  53.84      0 MASS609
CONM2      610      110      -1      6.77  158.54     111.75  54.51      0 MASS610
CONM2      611      111      -1      6.66  158.65     124.90  55.18      0 MASS611
CONM2      612      112      -1      6.57  158.71     138.04  55.86      0 MASS612
CONM2      613      113      -1      6.49  158.77     151.19  56.54      0 MASS613
CONM2      614      114      -1      6.41  158.82     164.34  57.22      0 MASS614
CONM2      615      115      -1      6.35  158.83     177.49  57.91      0 MASS615
CONM2      616      116      -1      6.30  158.82     190.63  58.60      0 MASS616
CONM2      617      117      -1      6.26  158.79     203.78  59.29      0 MASS617
CONM2      618      118      -1      6.24  158.74     216.93  59.99      0 MASS618
CONM2      619      119      -1      6.19  158.66     230.07  60.69      0 MASS619
$
+MASS602    114.0      0  2357.1      0      0  2471.1
+MASS603    111.7      0  2285.6      0      0  2397.2
+MASS604    109.4      0  2216.7      0      0  2326.1
+MASS605    107.3      0  2150.3      0      0  2257.6
+MASS606    105.2      0  2086.5      0      0  2191.6
+MASS607    103.2      0  2025.0      0      0  2128.2
+MASS608    101.2      0  1966.0      0      0  2067.2
+MASS609     99.4      0  1909.2      0      0  2008.6
+MASS610     97.6      0  1854.7      0      0  1952.3
+MASS611     95.9      0  1802.8      0      0  1898.7
+MASS612     94.6      0  1760.2      0      0  1854.9
+MASS613     93.4      0  1719.1      0      0  1812.6
+MASS614     92.3      0  1679.5      0      0  1771.8
+MASS615     91.5      0  1646.6      0      0  1738.0
+MASS616     90.7      0  1615.4      0      0  1706.1
+MASS617     90.2      0  1587.8      0      0  1678.0
+MASS618     89.8      0  1563.6      0      0  1653.4
+MASS619     88.9      0  1527.9      0      0  1616.9
$
$ *****
$ BEGIN FUEL STATIONS
$ *****
$
$ No Fuel
$
$CONM2      620      120      -1      6.14  158.56     243.20  61.53      0 MASS620
$CONM2      621      121      -1      6.10  158.46     256.33  62.23      0 MASS621
$CONM2      622      122      -1      6.05  158.36     269.46  62.93      0 MASS622
$CONM2      623      123      -1      6.00  158.26     282.59  63.63      0 MASS623
$CONM2      624      124      -1      5.95  158.16     295.72  64.33      0 MASS624
$CONM2      625      125      -1      5.91  158.06     308.85  65.03      0 MASS625
$CONM2      626      126      -1      5.86  157.96     321.98  65.73      0 MASS626
$
$ No Fuel
$
$+MASS620    88.3      0  1485.1      0      0  1573.4
$+MASS621    87.6      0  1443.1      0      0  1530.7
$+MASS622    86.9      0  1402.0      0      0  1488.9
$+MASS623    86.2      0  1361.5      0      0  1447.8

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\$+MASS624	85.5	0	1321.9	0	0	1407.5		
\$+MASS625	84.9	0	1283.1	0	0	1367.9		
\$+MASS626	84.2	0	1245.0	0	0	1329.1		
\$								
\$ With Fuel								
\$								
CONM2	620	120	-1	56.86	157.65	243.20	61.53	0 MASS620
CONM2	621	121	-1	55.70	157.57	256.33	62.23	0 MASS621
CONM2	622	122	-1	54.55	157.49	269.46	62.93	0 MASS622
CONM2	623	123	-1	53.41	157.41	282.59	63.63	0 MASS623
CONM2	624	124	-1	52.28	157.33	295.72	64.33	0 MASS624
CONM2	625	125	-1	51.17	157.25	308.85	65.03	0 MASS625
CONM2	626	126	-1	50.07	157.17	321.98	65.73	0 MASS626
\$								
\$ With Fuel								
\$								
+MASS620	816.9	0	8807.9	0	0	9165.0		
+MASS621	800.2	0	8456.6	0	0	8805.8		
+MASS622	783.7	0	8116.0	0	0	8457.4		
+MASS623	767.3	0	7785.8	0	0	8119.6		
+MASS624	751.2	0	7465.9	0	0	7792.1		
+MASS625	735.2	0	7156.0	0	0	7474.7		
+MASS626	719.4	0	6856.0	0	0	7167.2		
\$								
\$	*****							
\$	END FUEL STATIONS							
\$	*****							
\$								
CONM2	627	127	-1	5.81	157.86	335.11	66.31	0 MASS627
CONM2	628	128	-1	5.76	157.76	348.24	67.01	0 MASS628
CONM2	629	129	-1	5.72	157.66	361.37	67.71	0 MASS629
CONM2	630	130	-1	5.67	157.56	374.50	68.42	0 MASS630
CONM2	631	131	-1	5.62	157.46	387.63	69.12	0 MASS631
CONM2	632	132	-1	5.58	157.37	400.76	69.82	0 MASS632
CONM2	633	133	-1	5.53	157.27	413.89	70.52	0 MASS633
CONM2	634	134	-1	5.48	157.17	427.02	71.23	0 MASS634
CONM2	635	135	-1	5.43	157.07	440.15	71.93	0 MASS635
CONM2	636	136	-1	12.39	155.86	453.28	72.81	0 MASS636
CONM2	637	137	-1	5.34	156.87	466.41	73.33	0 MASS637
CONM2	638	138	-1	12.29	155.76	479.54	74.19	0 MASS638
CONM2	639	139	-1	5.24	156.67	492.67	74.74	0 MASS639
CONM2	640	140	-1	12.20	155.67	505.80	75.58	0 MASS640
CONM2	641	141	-1	5.15	156.47	518.93	76.14	0 MASS641
\$								
+MASS627	83.5	0	1207.6	0	0	1291.1		
+MASS628	82.8	0	1171.0	0	0	1253.8		
+MASS629	82.1	0	1135.2	0	0	1217.3		
+MASS630	81.5	0	1100.0	0	0	1181.5		
+MASS631	80.8	0	1065.6	0	0	1146.4		
+MASS632	80.1	0	1031.9	0	0	1112.0		
+MASS633	79.4	0	999.0	0	0	1078.4		
+MASS634	78.7	0	966.7	0	0	1045.4		
+MASS635	78.1	0	935.1	0	0	1013.2		
+MASS636	77.4	0	974.4	0	0	974.4		
+MASS637	76.7	0	874.0	0	0	950.7		
+MASS638	76.0	0	912.3	0	0	912.3		
+MASS639	75.3	0	815.6	0	0	890.9		
+MASS640	74.7	0	853.1	0	0	853.1		
+MASS641	74.0	0	759.8	0	0	833.8		
\$								
\$	LUMPED MASSES ON RIGHT WING-TIP BOOM							
CONM2	702	202	-1	11.25	33.61	525.50	77.50	0 MASS702
CONM2	703	203	-1	16.33	42.22	525.50	77.50	0 MASS703

CONM2	704	204	-1	16.41	50.83	525.50	77.50	0 MASS704
CONM2	705	205	-1	11.48	59.44	525.50	77.50	0 MASS705
CONM2	706	206	-1	1.56	68.06	525.50	77.50	0 MASS706
CONM2	707	207	-1	1.64	76.67	525.50	77.50	0 MASS707
CONM2	708	208	-1	1.72	85.28	525.50	77.50	0 MASS708
CONM2	709	209	-1	1.79	93.89	525.50	77.50	0 MASS709
CONM2	710	210	-1	1.87	102.50	525.50	77.50	0 MASS710
CONM2	711	211	-1	1.95	111.11	525.50	77.50	0 MASS711
CONM2	712	212	-1	2.02	119.72	525.50	77.50	0 MASS712
CONM2	713	213	-1	2.10	128.33	525.50	77.50	0 MASS713
CONM2	714	214	-1	2.18	136.94	525.50	77.50	0 MASS714
CONM2	715	215	-1	2.25	145.56	525.50	77.50	0 MASS715
CONM2	716	216	-1	2.22	154.17	525.50	77.50	0 MASS716
CONM2	717	217	-1	2.18	162.78	525.50	77.50	0 MASS717
CONM2	718	218	-1	5.65	171.39	525.50	77.50	0 MASS718
CONM2	719	219	-1	2.11	180.00	525.50	77.50	0 MASS719
CONM2	720	220	-1	2.41	190.00	525.50	77.50	0 MASS720
CONM2	721	221	-1	2.35	200.00	525.50	77.50	0 MASS721
CONM2	722	222	-1	2.30	210.00	525.50	77.50	0 MASS722
CONM2	723	223	-1	2.24	220.00	525.50	77.50	0 MASS723
CONM2	724	224	-1	2.17	230.00	525.50	77.50	0 MASS724
CONM2	725	225	-1	2.11	240.00	525.50	77.50	0 MASS725
CONM2	726	226	-1	2.05	250.00	525.50	77.50	0 MASS726
CONM2	727	227	-1	1.98	260.00	525.50	77.50	0 MASS727
CONM2	728	228	-1	1.91	270.00	525.50	77.50	0 MASS728
CONM2	729	229	-1	1.84	280.00	525.50	77.50	0 MASS729
CONM2	730	230	-1	1.89	290.00	525.50	77.50	0 MASS730
CONM2	731	231	-1	1.81	300.00	525.50	77.50	0 MASS731
CONM2	732	232	-1	1.73	310.00	525.50	77.50	0 MASS732
CONM2	733	233	-1	1.76	320.00	525.50	77.50	0 MASS733
CONM2	734	234	-1	1.66	330.00	525.50	77.50	0 MASS734
CONM2	735	235	-1	1.56	340.00	525.50	77.50	0 MASS735
CONM2	736	236	-1	1.56	350.00	525.50	77.50	0 MASS736
CONM2	737	237	-1	1.54	360.00	525.50	77.50	0 MASS737
CONM2	738	238	-1	1.42	370.00	525.50	77.50	0 MASS738
CONM2	739	239	-1	1.37	380.00	525.50	77.50	0 MASS739
CONM2	740	240	-1	1.31	390.00	525.50	77.50	0 MASS740
CONM2	741	241	-1	1.29	400.00	525.50	77.50	0 MASS741
CONM2	742	242	-1	0.80	410.00	525.50	77.50	0 MASS742
CONM2	743	243	-1	0.71	420.00	525.50	77.50	0 MASS743

\$

\$

+MASS702	316.5	0	126.6	0	0	126.6
+MASS703	459.3	0	330.6	0	0	330.6
+MASS704	461.5	0	332.1	0	0	332.1
+MASS705	323.0	0	232.5	0	0	232.5
+MASS706	87.8	0	53.6	0	0	53.6
+MASS707	92.2	0	56.2	0	0	56.2
+MASS708	96.5	0	58.8	0	0	58.8
+MASS709	100.8	0	61.5	0	0	61.5
+MASS710	105.1	0	64.1	0	0	64.1
+MASS711	109.5	0	66.8	0	0	66.8
+MASS712	113.8	0	69.4	0	0	69.4
+MASS713	118.1	0	72.0	0	0	72.0
+MASS714	122.5	0	74.7	0	0	74.7
+MASS715	126.8	0	77.3	0	0	77.3
+MASS716	124.8	0	76.1	0	0	76.1
+MASS717	122.7	0	74.9	0	0	74.9
+MASS718	158.8	0	114.3	0	0	114.3
+MASS719	118.7	0	72.4	0	0	72.4
+MASS720	128.9	0	84.6	0	0	84.6
+MASS721	119.5	0	79.4	0	0	79.4
+MASS722	110.5	0	74.4	0	0	74.4

+MASS723	101.8	0	69.6	0	0	69.6
+MASS724	93.6	0	64.9	0	0	64.9
+MASS725	85.8	0	60.5	0	0	60.5
+MASS726	78.3	0	56.2	0	0	56.2
+MASS727	71.3	0	52.1	0	0	52.1
+MASS728	64.5	0	48.2	0	0	48.2
+MASS729	58.2	0	44.4	0	0	44.4
+MASS730	56.0	0	43.8	0	0	43.8
+MASS731	50.0	0	40.1	0	0	40.1
+MASS732	44.3	0	36.6	0	0	36.6
+MASS733	41.8	0	35.5	0	0	35.5
+MASS734	36.5	0	32.1	0	0	32.1
+MASS735	31.6	0	28.8	0	0	28.8
+MASS736	29.0	0	27.5	0	0	27.5
+MASS737	26.2	0	26.0	0	0	26.0
+MASS738	21.9	0	22.8	0	0	22.8
+MASS739	19.3	0	21.1	0	0	21.1
+MASS740	16.6	0	19.2	0	0	19.2
+MASS741	14.7	0	18.1	0	0	18.1
+MASS742	8.1	0	10.7	0	0	10.7
+MASS743	6.4	0	9.1	0	0	9.1

\$ LUMPED MASSES FOR RIGHT SIDE HORIZONTAL TAIL

CONM2	802	302	-1	4.97	387.10	530.25	77.80	0 MASS802
CONM2	803	303	-1	4.73	386.66	539.75	79.47	0 MASS803
CONM2	804	304	-1	7.69	387.79	549.25	81.06	0 MASS804
CONM2	805	305	-1	4.26	385.75	558.75	82.82	0 MASS805
CONM2	806	306	-1	4.03	385.29	568.25	84.49	0 MASS806
CONM2	807	307	-1	7.00	387.18	577.75	86.04	0 MASS807
CONM2	808	308	-1	3.58	384.33	587.25	87.84	0 MASS808
CONM2	809	309	-1	3.35	383.83	596.75	89.51	0 MASS809
CONM2	810	310	-1	6.34	386.70	606.25	91.01	0 MASS810
CONM2	811	311	-1	2.92	382.81	615.75	92.87	0 MASS811

\$

+MASS802	37.4	0	1504.7	0	0	1542.1
+MASS803	35.6	0	1289.2	0	0	1324.7
+MASS804	33.8	0	1149.5	0	0	1149.5
+MASS805	32.0	0	923.6	0	0	955.6
+MASS806	30.3	0	770.9	0	0	801.2
+MASS807	28.6	0	710.0	0	0	710.0
+MASS808	26.9	0	519.2	0	0	546.1
+MASS809	25.2	0	417.6	0	0	442.8
+MASS810	23.6	0	427.7	0	0	427.7
+MASS811	22.0	0	256.7	0	0	278.7

\$ LUMPED MASSES FOR RIGHT SIDE VERTICAL TAIL

CONM2	902	402	-1	3.06	413.63	524.05	81.48	0 MASS902
CONM2	903	403	-1	2.91	414.65	521.15	89.45	0 MASS903
CONM2	904	404	-1	5.97	418.34	518.25	97.42	0 MASS904
CONM2	905	405	-1	2.63	416.67	515.35	105.39	0 MASS905
CONM2	906	406	-1	2.49	417.67	512.45	113.36	0 MASS906
CONM2	907	407	-1	2.36	418.66	509.55	121.33	0 MASS907
CONM2	908	408	-1	5.43	422.59	506.65	129.30	0 MASS908
CONM2	909	409	-1	2.1	420.61	503.75	137.27	0 MASS909
CONM2	910	410	-1	1.98	421.57	500.85	145.23	0 MASS910
CONM2	911	411	-1	1.86	422.50	497.95	153.20	0 MASS911

\$

+MASS902	18.3	0	616.3	0	0	597.9
+MASS903	17.5	0	547.1	0	0	529.7
+MASS904	16.6	0	483.7	0	0	467.1
+MASS905	15.8	0	425.8	0	0	410.0
+MASS906	14.9	0	373.1	0	0	358.2
+MASS907	14.1	0	325.3	0	0	311.2
+MASS908	13.3	0	282.3	0	0	269.0
+MASS909	12.6	0	243.7	0	0	231.1

+MASS910	11.8	0	209.3	0	0	197.5
+MASS911	11.1	0	178.9	0	0	167.8

\$

\$

PBEAM	2301	1	100.	1000.	1000.	0.	1000.
-------	------	---	------	-------	-------	----	-------

PBEAM	2401	1	100.	1000.	1000.	0.	1000.
-------	------	---	------	-------	-------	----	-------

\$

\$ RIGHT SIDE BEAMS FROM H-TAIL MAIN BEAM TO HINGE LINE

CBEAM	2301	2301	301	2501	302
-------	------	------	-----	------	-----

CBEAM	2302	2301	302	2502	301
-------	------	------	-----	------	-----

CBEAM	2303	2301	303	2503	301
-------	------	------	-----	------	-----

CBEAM	2304	2301	304	2504	301
-------	------	------	-----	------	-----

CBEAM	2305	2301	305	2505	301
-------	------	------	-----	------	-----

CBEAM	2306	2301	306	2506	301
-------	------	------	-----	------	-----

CBEAM	2307	2301	307	2507	301
-------	------	------	-----	------	-----

CBEAM	2308	2301	308	2508	301
-------	------	------	-----	------	-----

CBEAM	2309	2301	309	2509	301
-------	------	------	-----	------	-----

CBEAM	2310	2301	310	2510	301
-------	------	------	-----	------	-----

CBEAM	2311	2301	311	2511	301
-------	------	------	-----	------	-----

\$

\$ RIGHT SIDE BEAMS FROM H-TAIL HINGE LINE TO H-TAIL TRAILING EDGE

CBEAM	2321	2301	2501	2301	2502
-------	------	------	------	------	------

CBEAM	2322	2301	2502	2302	2501
-------	------	------	------	------	------

CBEAM	2323	2301	2503	2303	2501
-------	------	------	------	------	------

CBEAM	2324	2301	2504	2304	2501
-------	------	------	------	------	------

CBEAM	2325	2301	2505	2305	2501
-------	------	------	------	------	------

CBEAM	2326	2301	2506	2306	2501
-------	------	------	------	------	------

CBEAM	2327	2301	2507	2307	2501
-------	------	------	------	------	------

CBEAM	2328	2301	2508	2308	2501
-------	------	------	------	------	------

CBEAM	2329	2301	2509	2309	2501
-------	------	------	------	------	------

CBEAM	2330	2301	2510	2310	2501
-------	------	------	------	------	------

CBEAM	2331	2301	2511	2311	2501
-------	------	------	------	------	------

\$ RIGHT SIDE BEAMS FROM V-TAIL MAIN BEAM TO HINGE LINE

CBEAM	2401	2401	401	2601	402
-------	------	------	-----	------	-----

CBEAM	2402	2401	402	2602	401
-------	------	------	-----	------	-----

CBEAM	2403	2401	403	2603	401
-------	------	------	-----	------	-----

CBEAM	2404	2401	404	2604	401
-------	------	------	-----	------	-----

CBEAM	2405	2401	405	2605	401
-------	------	------	-----	------	-----

CBEAM	2406	2401	406	2606	401
-------	------	------	-----	------	-----

CBEAM	2407	2401	407	2607	401
-------	------	------	-----	------	-----

CBEAM	2408	2401	408	2608	401
-------	------	------	-----	------	-----

CBEAM	2409	2401	409	2609	401
-------	------	------	-----	------	-----

CBEAM	2410	2401	410	2610	401
-------	------	------	-----	------	-----

CBEAM	2411	2401	411	2611	401
-------	------	------	-----	------	-----

\$

\$ RIGHT SIDE BEAMS FROM V-TAIL HINGE LINE TO V-TAIL TRAILING EDGE

CBEAM	2421	2401	2601	2401	2602
-------	------	------	------	------	------

CBEAM	2422	2401	2602	2402	2601
-------	------	------	------	------	------

CBEAM	2423	2401	2603	2403	2601
-------	------	------	------	------	------

CBEAM	2424	2401	2604	2404	2601
-------	------	------	------	------	------

CBEAM	2425	2401	2605	2405	2601
-------	------	------	------	------	------

CBEAM	2426	2401	2606	2406	2601
-------	------	------	------	------	------

CBEAM	2427	2401	2607	2407	2601
-------	------	------	------	------	------

CBEAM	2428	2401	2608	2408	2601
-------	------	------	------	------	------

CBEAM	2429	2401	2609	2409	2601
-------	------	------	------	------	------

CBEAM	2430	2401	2610	2410	2601
-------	------	------	------	------	------

CBEAM	2431	2401	2611	2411	2601
-------	------	------	------	------	------

\$

ENDDATA

APPENDIX C

MSC/NASTRAN file used in the one-dimensional gust analysis

```
$ TO EXECUTE THIS FILE USE THE FOLLOWING:
$ NAST705 VK06 SCRATCH=YES MEM=12MW NEWS=NO
$
SOL 146 $ AEROELASTIC DYNAMIC RESPONSE
TIME 120.0 $ TIME IN MINUTES
$
CEND
$
TITLE = SEMISPAN MODEL * VON KARMAN PSD * M=0.090 * H=1000.0 FT.
SUBTITLE = SYMMETRIC RESPONSE * FUEL 166.95 LB. * V=98.3 FT/SEC
LABEL = GUST SCALE LENGTH=1000 FEET * GUST VELOCITY=1.0 IN/SEC.
$
METHOD = 1 $ SINV EIGENVALUE EXTRACTION METHOD
SPC = 1 $ BOUNDARY CONDITION CONSTRAINTS
SDAMPING = 25 $ MODAL STRUCTURAL DAMPING (TABDMP1)
FREQUENCY = 41 $ SET OF SOLUTION FORCING FREQUENCIES (FREQ1)
RANDOM = 111 $ PSD SPECIFICATION (RANDPS)
K2PP = STIFF $ D.O.F. FOR OUTPUT OF VON KARMAN SPECTRUM (DMIG)
$ ECHO = UNSORT
ECHO = NONE $ SUPPRESS PRINTOUT OF BULK DATA DECK
$
OUTPUT
$
SET 40 = 9990 $ EXTRA POINT FOR GENERATION OF VON KARMAN PSD
DISPLACEMENT(PHASE) = 40
SDISPLACEMENT(PHASE) = 40
$
SUBCASE 1 $ APPLY VON KARMAN GUST
GUST = 36 $ GUST SELECTION (GUST)
DLOAD = 46 $ APPLY LOAD TO EPOINT TO GET PSD OF GUST (RLOAD1)
$
OUTPUT(XYOUT)
XYPRINT SDISP PSDF/9990(T1)
XYPRINT DISP PSDF/9990(T1)
XYPRINT ACCE PSDF/95(T1)
XYPRINT ACCE PSDF/95(T3)
XYPRINT ACCE PSDF/95(R2)
XYPRINT ELFORCE PSDF/101(4)
XYPRINT ELFORCE PSDF/101(5)
XYPRINT ELFORCE PSDF/101(6)
XYPRINT ELFORCE PSDF/101(7)
XYPRINT ELFORCE PSDF/101(9)
XYPRINT ELFORCE PSDF/140(4)
XYPRINT ELFORCE PSDF/140(5)
XYPRINT ELFORCE PSDF/140(6)
XYPRINT ELFORCE PSDF/140(7)
XYPRINT ELFORCE PSDF/140(9)
XYPRINT ELFORCE PSDF/216(164)
XYPRINT ELFORCE PSDF/216(165)
XYPRINT ELFORCE PSDF/216(166)
XYPRINT ELFORCE PSDF/216(167)
XYPRINT ELFORCE PSDF/216(169)
XYPRINT ELFORCE PSDF/217(4)
XYPRINT ELFORCE PSDF/217(5)
XYPRINT ELFORCE PSDF/217(6)
XYPRINT ELFORCE PSDF/217(7)
XYPRINT ELFORCE PSDF/217(9)
$
```

```

BEGIN BULK
$
$ INPUT UNITS: ARE INCHES, POUNDS, SECONDS FOR LENGTH, MASS, AND TIME
$
PARAM, POST, -1 $ IDEAS POST-PROCESSING
$
PARAM, LMODES, 32 $ USE THE 32 LOWEST NORMAL MODES
$
$ PARAM, VREF, 20.2537 $ CONVERT FROM IN/SEC TO KNOTS IN SOL 145
$ PARAM, VREF, 12.0 $ USE VELOCITY UNITS OF FEET/SECOND IN SOL 145
$
$ CHANGES "WEIGHT" INPUT DATA TO "MASS" DATA
PARAM,WTMASS,0.002588
$
$ REQUESTS MASS PROPERTIES SUMMARY
PARAM,GRDPNT,0 $ WITH RESPECT TO ORIGIN OF BASIC C.S.
$
$ DEFINE LOCAL COORDINATE SYSTEMS FOR HORIZONTAL AND VERTICAL TAILS
SPC1, 1, 123456, 30, 40 $ GRIDS 30 AND 40 ONLY USED FOR ORIENTATION
GRID, 30, 0, 379.75, 521.5678, 100.0 $ DEFINES DIRECTION OF Z-AXIS (H-TAIL)
GRID, 40, 0, 410.39, 587.3362, 100.0 $ DEFINES DIRECTION OF Z-AXIS (V-TAIL)
$
$ COORDINATE SYSTEM 12 IS A REFERENCE AXIS SYSTEM FOR STABILITY DERIVATIVES
CORD2R 12 0 156.51 0.0 48.98 156.51 0.0 40.0 +CO12
+CO12 140.0 0.0 48.98
$ LOCAL COORD. SYSTEM FOR HORIZONTAL TAIL
CORD1R, 5, 301, 30, 2301 $ Z-AXIS NORMAL TO PLANE OF HORIZ. TAIL
$ LOCAL COORD. SYSTEM FOR VERTICAL TAIL
CORD1R, 6, 401, 40, 2401 $ Z-AXIS NORMAL TO PLANE OF VERT. TAIL
$
$ LOCAL COORDINATE SYSTEM TO DEFINE Y-AXIS OF RIGHT H-TAIL HINGE LINE
CORD2R 13 0 404.480 525.50 77.360 404.480521.5678 100.0 +CO13
+CO13 450.0531.888378.46955
$ LOCAL COORDINATE SYSTEM TO DEFINE Y-AXIS OF RIGHT V-TAIL HINGE LINE
CORD2R 14 0 433.14 496.50 157.190 433.140614.1537 200.0 +CO14
+CO14 500.0497.3168154.9451
$
$ SELECT THE DESIRED BOUNDARY CONDITIONS
$ Fixed Root
$ SPC 1 101 123456 0.
$
$ Symmetric BC * CONSTRAIN GRIDS ON CENTERLINE
SPC 1 101 246 0.0 95 246 0.0
$
$ Antisymmetric BC
$ SPC 1 101 135 0.
$
$ *****
$ SECTION FOR DYNAMIC RESPONSE TO GUST LOADING
$ *****
$
PARAM, MACH, 0.090 $ DESIRED MACH NUMBER
PARAM, Q, 0.077444 $ DYNAMIC PRESSURE IN PSI AT 1000 FT. (V=1179.6 IN/SEC)
PARAM, GUSTAERO, -1
$
$ STRUCTURAL MODAL DAMPING = 0.02 IN EACH MODE
TABDMPI 25 G +TDMP1
+TDMP1 0.0 0.02 60.0 0.02 ENDT
$
$ *****
$ FOLLOWING GROUP OF INPUT IS FOR THE VON KARMAN PSD
$
RANDPS 111 1 1 1.0 0.0 121

```



```

$ VON KARMAN GUST WITH (L/U)=10.1729 SEC., AND WG=1.0 IN/SEC
TABRNDG      121      1 10.1729      1.0
$ VELOCITY ON 'GUST' MUST BE SAME AS ON 'AERO' INPUT RECORD.
GUST         36      468.4774-4      0.0 1179.6
RLOAD1       46      56                      66
$ APPLY VON KARMAN GUST TO THE EPOINT FOR SUBSEQUENT OUTPUT
DAREA        56      9990      1.0
EPOINT       9990
$ TABLED1 PROVIDES FREQUENCY INTERVAL OVER WHICH LOADS ARE GENERATED
TABLED1      66                                     +TDVK1
+TDVK1       0.0      1.0      60.0      1.0      ENDT
$ SETS OF FREQUENCIES USED IN SOLUTION OF FREQUENCY RESPONSE PROBLEMS
FREQ1       41  0.0001  0.0001      9
FREQ1       41  0.001  0.001      9
FREQ1       41  0.010  0.010      9
FREQ1       41  0.10   0.05   1198
$ DMIG DEFINES AN EPOINT USED TO OUTPUT THE VON KARMAN PSD
DMIG        STIFF      0      6      1      0
DMIG        STIFF      9990      0      9990      0      1.0
$
$ *****
$ END OF SECTION FOR DYNAMIC RESPONSE TO GUST LOADING
$ *****
$ *****
$ BEGIN AERODYNAMIC FLUTTER CARDS
$ *****
$
$ VALUE OF FIELD 6 (SYMxz) IS 1 FOR SYM CASE, -1 FOR ASYM, 0 FOR FIXED
$      2      3      4      5      6      7      8      9      1
$ AERO. DENSITY UNITS: LB-SEC**2/IN**4 (SEA-LEVEL)
AERO        0 1179.6  54.031.1463-7      1      0
$
$ Inboard Wing (RIGHT SIDE)
CAERO1 10001 1      0      17      8      1      +CA101
+CA101 132.83 0.0      48.98  59.2      134.33  223.5  60.77  54.03
$
$ GRID 101      0      156.51  0.00  48.98
$ (156.51-132.83)/59.2=0.40 chord
$
$ Outboard Wing (RIGHT SIDE)
CAERO1 20001 1      0      23      8      1      +CA102
+CA102 134.33 223.5  60.77  54.03  138.03  525.5  76.79  41.28
$
$ GRID 118      0      155.94  223.50  60.77
$ (155.94-134.33)/54.03=0.40 chord
$
$ RIGHT-SIDE HORIZONTAL TAIL
$ THE H-TAIL PANEL SPANS THE AREA FROM THE LEADING EDGE TO THE HINGE LINE
CAERO1 30001 1      0      20      8      1      +CA103
+CA103 355.08 525.5  77.36  49.40  366.04  620.5  93.92  24.704
$
$ RIGHT-SIDE CONTROL SURFACE PANEL ON HORIZONTAL TAIL
CAERO1 31001 1      0      20      2      1      +CA103A
+CA103A 404.480 525.50  77.360  12.35  390.744  620.50  93.920  6.176
$
$ GRID 301      0      379.75  525.50  77.36
$ (379.75-355.08)/61.75=0.40 chord
$
$ RIGHT-SIDE VERTICAL TAIL
$ CAERO1 40001 1      0      16      8      1      +CA104
$ +CA104 390.67 525.5  77.5  49.3  407.54  496.5  157.19  32.00
$

```

```

$ REDEFINE POINTS 1 AND 4 FOR VERTICAL TAIL (SWAP POINTS 1 AND 4)
CAERO1 40001 1 0 20 8 1 +CA104
+CA104 407.54 496.5 157.19 25.60 390.67 525.5 77.5 39.44
$
$ RIGHT-SIDE CONTROL SURFACE PANEL ON VERTICAL TAIL
CAERO1 41001 1 0 20 2 1 +CA104A
+CA104A 433.140 496.50 157.190 6.40 430.110 525.50 77.50 9.86
$
$GRID 401 0 410.39 525.50 77.50
$ (410.39-390.67)/49.30=0.40 chord
$
$ DENS MACH VEL INTERP MODES PK TOL (0.001 default)
FLUTTER 30 PK 1 2 4 L 10
FLFACT 1 1.0
FLFACT 2 0.0
$
$ FOR PK METHOD, 'FLFACT 4' IS A VELOCITY TABLE (UNITS IN/SEC)
$ A MINUS SIGN FOR A VELOCITY IS A REQUEST FOR EIGENVALUE OUTPUT
FLFACT 4 176.0 528.0 880.0 1320.0 1760.0 2640.0 3520.0 +FL01
+FL01 4400.0 5280.0 6200.0 7040.0
$
$ TABLES OF MACH NUMBER AND REDUCED FREQUENCY
MKAERO1 0.09 +MK1
+MK1 0.00001 0.005 0.01 0.02 0.04 0.06 0.08 0.1
MKAERO1 0.09 +MK2
+MK2 0.2 0.4 0.6 0.8 1.0 2.0 3.0 4.0
MKAERO1 0.09 +MK3
+MK3 5.0 6.0 7.0 8.0 9.0 10.0
$
PAERO1 1
$
$ TEST USAGE OF SURFACE SPLINES ON ALL LIFTING SURFACES
$ SPLINE1 = 100 RIGHT-SIDE INBOARD WING
$ SPLINE1 = 200 RIGHT-SIDE OUTBOARD WING
$ SPLINE1 = 300 RIGHT-SIDE HORIZONTAL TAIL WITHOUT CONTROL SURFACE
$ SPLINE1 = 305 RIGHT-SIDE CONTROL SURFACE ON HORIZONTAL TAIL
$ SPLINE1 = 400 RIGHT-SIDE VERTICAL TAIL WITHOUT CONTROL SURFACE
$ SPLINE1 = 405 RIGHT-SIDE CONTROL SURFACE ON VERTICAL TAIL
$
SPLINE1 100 10001 10001 10136 100
SPLINE1 200 20001 20001 20184 200
$
SPLINE1 300 30001 30001 30160 300
SPLINE1 400 40001 40001 40160 400
$
SPLINE1 305 31001 31001 31040 305
SPLINE1 405 41001 41001 41040 405
$
$ GRIDS UTILIZED FOR RIGHT SIDE INBOARD WING SURFACE SPLINES
SET1 100 101 102 103 104 105 106 107+IW01
+IW01 108 109 110 111 112 113 114 115+IW02
+IW02 116 117 118 1101 1102 1103 1104 1105+IW03
+IW03 1106 1107 1108 1109 1110 1111 1112 1113+IW04
+IW04 1114 1115 1116 1117 1118 2101 2102 2103+IW05
+IW05 2104 2105 2106 2107 2108 2109 2110 2111+IW06
+IW06 2112 2113 2114 2115 2116 2117 2118
$
$ GRIDS UTILIZED FOR RIGHT SIDE OUTBOARD WING SURFACE SPLINES
SET1 200 118 119 120 121 122 123 124+OW01
+OW01 125 126 127 128 129 130 131 132+OW02
+OW02 133 134 135 136 137 138 139 140+OW03
+OW03 141 1118 1119 1120 1121 1122 1123 1124+OW04
+OW04 1125 1126 1127 1128 1129 1130 1131 1132+OW05
+OW05 1133 1134 1135 1136 1137 1138 1139 1140+OW06

```

+OW06	1141	2118	2119	2120	2121	2122	2123	2124+OW07
+OW07	2125	2126	2127	2128	2129	2130	2131	2132+OW08
+OW08	2133	2134	2135	2136	2137	2138	2139	2140+OW09
+OW09	2141							

\$ GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON H-TAIL

SET1	300	301	302	303	304	305	306	307+HT01
+HT01	308	309	310	311	1301	1302	1303	1304+HT02
+HT02	1305	1306	1307	1308	1309	1310	1311	2501+HT03
+HT03	2502	2503	2504	2505	2506	2507	2508	2509+HT04
+HT04	2510	2511						

\$ GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON H-TAIL CONTROL SURFACE

SET1	305	2501	2502	2503	2504	2505	2506	2507+HC01
+HC01	2508	2509	2510	2511	2301	2302	2303	2304+HC02
+HC02	2305	2306	2307	2308	2309	2310	2311	

\$ GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON V-TAIL

SET1	400	401	402	403	404	405	406	407+VT01
+VT01	408	409	410	411	1401	1402	1403	1404+VT02
+VT02	1405	1406	1407	1408	1409	1410	1411	2601+VT03
+VT03	2602	2603	2604	2605	2606	2607	2608	2609+VT04
+VT04	2610	2611						

\$ GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON V-TAIL CONTROL SURFACE

SET1	405	2601	2602	2603	2604	2605	2606	2607+VC01
+VC01	2608	2609	2610	2611	2401	2402	2403	2404+VC02
+VC02	2405	2406	2407	2408	2409	2410	2411	

\$

\$ ***** END OF AERODYNAMIC FLUTTER INPUTS *****

\$

EIGR	1	SINV	0.0	60.0		40	
------	---	------	-----	------	--	----	--

\$

\$ CREATE A NEW GRID POINT AT THE C.G. FOR THE CURRENT FUEL MASS CONDITION

\$ USE A CBEAM TO CONNECT THIS NEW GRID TO GRID 101

GRID	95		0160.9484	0.077.08521		0	
CBEAM	95	95	101	95	1.0	0.0	0.0
PBEAM	95	1	100.0	1000.0	1000.0	0.0	1000.0

\$

\$ GRID 100 REPRESENTS PROPULSION SYSTEM

RBE2	504	101	123456	100			
------	-----	-----	--------	-----	--	--	--

\$ CONNECTIONS TO WING-TIP BOOM, HORIZONTAL AND VERTICAL TAILS

\$

RBE2	501	141	123456	216			
RBE2	502	238	123456	301			
RBE2	503	240	123456	401			

\$

GRID	100	0	125.8	0.0	86.1	0	
------	-----	---	-------	-----	------	---	--

\$

\$ GRIDS FOR RIGHT WING BEAM

\$

GRID	101	0	156.51	0.00	48.98	0	
GRID	102	0	156.48	13.15	49.67	0	
GRID	103	0	156.45	26.29	50.37	0	
GRID	104	0	156.41	39.44	51.06	0	
GRID	105	0	156.38	52.59	51.75	0	
GRID	106	0	156.34	65.74	52.45	0	
GRID	107	0	156.31	78.88	53.14	0	
GRID	108	0	156.28	92.03	53.83	0	
GRID	109	0	156.24	105.18	54.53	0	
GRID	110	0	156.21	118.32	55.22	0	
GRID	111	0	156.18	131.47	55.91	0	
GRID	112	0	156.14	144.62	56.61	0	
GRID	113	0	156.11	157.76	57.30	0	
GRID	114	0	156.08	170.91	57.99	0	
GRID	115	0	156.04	184.06	58.69	0	
GRID	116	0	156.01	197.21	59.38	0	

GRID	117	0	155.98	210.35	60.07	0
GRID	118	0	155.94	223.50	60.77	0
GRID	119	0	155.88	236.63	61.46	0
GRID	120	0	155.82	249.76	62.16	0
GRID	121	0	155.76	262.89	62.86	0
GRID	122	0	155.70	276.02	63.55	0
GRID	123	0	155.64	289.15	64.25	0
GRID	124	0	155.58	302.28	64.95	0
GRID	125	0	155.52	315.41	65.64	0
GRID	126	0	155.46	328.54	66.34	0
GRID	127	0	155.39	341.67	67.04	0
GRID	128	0	155.33	354.80	67.73	0
GRID	129	0	155.27	367.93	68.43	0
GRID	130	0	155.21	381.07	69.13	0
GRID	131	0	155.15	394.20	69.82	0
GRID	132	0	155.09	407.33	70.52	0
GRID	133	0	155.03	420.46	71.22	0
GRID	134	0	154.97	433.59	71.91	0
GRID	135	0	154.91	446.72	72.61	0
GRID	136	0	154.85	459.85	73.31	0
GRID	137	0	154.79	472.98	74.00	0
GRID	138	0	154.72	486.11	74.70	0
GRID	139	0	154.66	499.24	75.40	0
GRID	140	0	154.60	512.37	76.09	0
GRID	141	0	154.54	525.50	76.79	0

\$

\$ RIGHT SIDE WING SURFACE LEADING-EDGE GRID POINTS

\$

GRID	1101	0	132.83	0.00	48.98	0
GRID	1102	0	132.92	13.15	49.67	0
GRID	1103	0	133.01	26.29	50.37	0
GRID	1104	0	133.10	39.44	51.06	0
GRID	1105	0	133.18	52.59	51.75	0
GRID	1106	0	133.27	65.74	52.45	0
GRID	1107	0	133.36	78.88	53.14	0
GRID	1108	0	133.45	92.03	53.83	0
GRID	1109	0	133.54	105.18	54.53	0
GRID	1110	0	133.63	118.32	55.22	0
GRID	1111	0	133.71	131.47	55.91	0
GRID	1112	0	133.80	144.62	56.61	0
GRID	1113	0	133.89	157.76	57.30	0
GRID	1114	0	133.98	170.91	57.99	0
GRID	1115	0	134.07	184.06	58.69	0
GRID	1116	0	134.16	197.21	59.38	0
GRID	1117	0	134.24	210.35	60.07	0
GRID	1118	0	134.33	223.50	60.77	0
GRID	1119	0	134.49	236.63	61.46	0
GRID	1120	0	134.65	249.76	62.16	0
GRID	1121	0	134.81	262.89	62.86	0
GRID	1122	0	134.97	276.02	63.55	0
GRID	1123	0	135.14	289.15	64.25	0
GRID	1124	0	135.30	302.28	64.95	0
GRID	1125	0	135.46	315.41	65.64	0
GRID	1126	0	135.62	328.54	66.34	0
GRID	1127	0	135.78	341.67	67.04	0
GRID	1128	0	135.94	354.80	67.73	0
GRID	1129	0	136.10	367.93	68.43	0
GRID	1130	0	136.26	381.07	69.13	0
GRID	1131	0	136.42	394.20	69.82	0
GRID	1132	0	136.58	407.33	70.52	0
GRID	1133	0	136.74	420.46	71.22	0
GRID	1134	0	136.90	433.59	71.91	0
GRID	1135	0	137.06	446.72	72.61	0

GRID	1136	0	137.22	459.85	73.31	0
GRID	1137	0	137.38	472.98	74.00	0
GRID	1138	0	137.55	486.11	74.70	0
GRID	1139	0	137.71	499.24	75.40	0
GRID	1140	0	137.87	512.37	76.09	0
GRID	1141	0	138.03	525.50	76.79	0

\$

\$ RIGHT SIDE WING SURFACE TRAILING-EDGE GRID POINTS

\$

GRID	2101	0	192.03	0.00	48.98	0
GRID	2102	0	191.82	13.15	49.67	0
GRID	2103	0	191.60	26.29	50.37	0
GRID	2104	0	191.39	39.44	51.06	0
GRID	2105	0	191.17	52.59	51.75	0
GRID	2106	0	190.95	65.74	52.45	0
GRID	2107	0	190.74	78.88	53.14	0
GRID	2108	0	190.52	92.03	53.83	0
GRID	2109	0	190.30	105.18	54.53	0
GRID	2110	0	190.09	118.32	55.22	0
GRID	2111	0	189.87	131.47	55.91	0
GRID	2112	0	189.66	144.62	56.61	0
GRID	2113	0	189.44	157.76	57.30	0
GRID	2114	0	189.22	170.91	57.99	0
GRID	2115	0	189.01	184.06	58.69	0
GRID	2116	0	188.79	197.21	59.38	0
GRID	2117	0	188.58	210.35	60.07	0
GRID	2118	0	188.36	223.50	60.77	0
GRID	2119	0	187.97	236.63	61.46	0
GRID	2120	0	187.57	249.76	62.16	0
GRID	2121	0	187.18	262.89	62.86	0
GRID	2122	0	186.79	276.02	63.55	0
GRID	2123	0	186.39	289.15	64.25	0
GRID	2124	0	186.00	302.28	64.95	0
GRID	2125	0	185.61	315.41	65.64	0
GRID	2126	0	185.21	328.54	66.34	0
GRID	2127	0	184.82	341.67	67.04	0
GRID	2128	0	184.43	354.80	67.73	0
GRID	2129	0	184.03	367.93	68.43	0
GRID	2130	0	183.64	381.07	69.13	0
GRID	2131	0	183.25	394.20	69.82	0
GRID	2132	0	182.85	407.33	70.52	0
GRID	2133	0	182.46	420.46	71.22	0
GRID	2134	0	182.07	433.59	71.91	0
GRID	2135	0	181.67	446.72	72.61	0
GRID	2136	0	181.28	459.85	73.31	0
GRID	2137	0	180.89	472.98	74.00	0
GRID	2138	0	180.49	486.11	74.70	0
GRID	2139	0	180.10	499.24	75.40	0
GRID	2140	0	179.71	512.37	76.09	0
GRID	2141	0	179.31	525.50	76.79	0

\$

\$ RIGHT WING * LEADING AND TRAILING EDGE GRIDS ARE DEPENDENT ON MAIN BEAM

\$

RBE2	1201	101	123456	1101	2101
RBE2	1202	102	123456	1102	2102
RBE2	1203	103	123456	1103	2103
RBE2	1204	104	123456	1104	2104
RBE2	1205	105	123456	1105	2105
RBE2	1206	106	123456	1106	2106
RBE2	1207	107	123456	1107	2107
RBE2	1208	108	123456	1108	2108
RBE2	1209	109	123456	1109	2109
RBE2	1210	110	123456	1110	2110

RBE2	1211	111	123456	1111	2111
RBE2	1212	112	123456	1112	2112
RBE2	1213	113	123456	1113	2113
RBE2	1214	114	123456	1114	2114
RBE2	1215	115	123456	1115	2115
RBE2	1216	116	123456	1116	2116
RBE2	1217	117	123456	1117	2117
RBE2	1218	118	123456	1118	2118
RBE2	1219	119	123456	1119	2119
RBE2	1220	120	123456	1120	2120
RBE2	1221	121	123456	1121	2121
RBE2	1222	122	123456	1122	2122
RBE2	1223	123	123456	1123	2123
RBE2	1224	124	123456	1124	2124
RBE2	1225	125	123456	1125	2125
RBE2	1226	126	123456	1126	2126
RBE2	1227	127	123456	1127	2127
RBE2	1228	128	123456	1128	2128
RBE2	1229	129	123456	1129	2129
RBE2	1230	130	123456	1130	2130
RBE2	1231	131	123456	1131	2131
RBE2	1232	132	123456	1132	2132
RBE2	1233	133	123456	1133	2133
RBE2	1234	134	123456	1134	2134
RBE2	1235	135	123456	1135	2135
RBE2	1236	136	123456	1136	2136
RBE2	1237	137	123456	1137	2137
RBE2	1238	138	123456	1138	2138
RBE2	1239	139	123456	1139	2139
RBE2	1240	140	123456	1140	2140
RBE2	1241	141	123456	1141	2141

\$

\$ GRIDS FOR RIGHT SIDE WING-TIP BOOM

\$

GRID	201	0	25.	525.5	77.5	0
GRID	202	0	33.6111	525.5	77.5	0
GRID	203	0	42.2222	525.5	77.5	0
GRID	204	0	50.8333	525.5	77.5	0
GRID	205	0	59.4444	525.5	77.5	0
GRID	206	0	68.0556	525.5	77.5	0
GRID	207	0	76.6667	525.5	77.5	0
GRID	208	0	85.2778	525.5	77.5	0
GRID	209	0	93.8889	525.5	77.5	0
GRID	210	0	102.5	525.5	77.5	0
GRID	211	0	111.111	525.5	77.5	0
GRID	212	0	119.722	525.5	77.5	0
GRID	213	0	128.333	525.5	77.5	0
GRID	214	0	136.944	525.5	77.5	0
GRID	215	0	145.556	525.5	77.5	0
GRID	216	0	154.167	525.5	77.5	0
GRID	217	0	162.778	525.5	77.5	0
GRID	218	0	171.389	525.5	77.5	0
GRID	219	0	180.	525.5	77.5	0
GRID	220	0	190.	525.5	77.5	0
GRID	221	0	200.	525.5	77.5	0
GRID	222	0	210.	525.5	77.5	0
GRID	223	0	220.	525.5	77.5	0
GRID	224	0	230.	525.5	77.5	0
GRID	225	0	240.	525.5	77.5	0
GRID	226	0	250.	525.5	77.5	0
GRID	227	0	260.	525.5	77.5	0
GRID	228	0	270.	525.5	77.5	0
GRID	229	0	280.	525.5	77.5	0

GRID	230	0	290.	525.5	77.5	0
GRID	231	0	300.	525.5	77.5	0
GRID	232	0	310.	525.5	77.5	0
GRID	233	0	320.	525.5	77.5	0
GRID	234	0	330.	525.5	77.5	0
GRID	235	0	340.	525.5	77.5	0
GRID	236	0	350.	525.5	77.5	0
GRID	237	0	360.	525.5	77.5	0
GRID	238	0	370.	525.5	77.5	0
GRID	239	0	380.	525.5	77.5	0
GRID	240	0	390.	525.5	77.5	0
GRID	241	0	400.	525.5	77.5	0
GRID	242	0	410.	525.5	77.5	0
GRID	243	0	420.	525.5	77.5	0

\$

\$

\$ RIGHT SIDE HORIZONTAL TAIL DEFINITION

\$

\$ GRIDS FOR RIGHT SIDE HORIZONTAL TAIL BEAM

\$

GRID	301	0	379.75	525.50	77.36	0
GRID	302	0	379.61	535.00	79.01	0
GRID	303	0	379.47	544.50	80.67	0
GRID	304	0	379.34	554.00	82.33	0
GRID	305	0	379.20	563.50	83.98	0
GRID	306	0	379.06	573.00	85.64	0
GRID	307	0	378.92	582.50	87.30	0
GRID	308	0	378.79	592.00	88.95	0
GRID	309	0	378.65	601.50	90.61	0
GRID	310	0	378.51	611.00	92.27	0
GRID	311	0	378.37	620.50	93.92	0

\$ DUPLICATE GRIDS FOR HORIZONTAL TAIL MAIN BEAM

\$ THE OUTPUT OF THESE GRIDS WILL BE IN COORD. SYST. 5

GRID	331	0	379.75	525.50	77.36	5
GRID	332	0	379.61	535.00	79.01	5
GRID	333	0	379.47	544.50	80.67	5
GRID	334	0	379.34	554.00	82.33	5
GRID	335	0	379.20	563.50	83.98	5
GRID	336	0	379.06	573.00	85.64	5
GRID	337	0	378.92	582.50	87.30	5
GRID	338	0	378.79	592.00	88.95	5
GRID	339	0	378.65	601.50	90.61	5
GRID	340	0	378.51	611.00	92.27	5
GRID	341	0	378.37	620.50	93.92	5

\$ DUPLICATE GRIDS ON H-TAIL ARE DEPENDENT ON ELASTIC AXIS BEAM

RBE2	521	301	123456	331
RBE2	522	302	123456	332
RBE2	523	303	123456	333
RBE2	524	304	123456	334
RBE2	525	305	123456	335
RBE2	526	306	123456	336
RBE2	527	307	123456	337
RBE2	528	308	123456	338
RBE2	529	309	123456	339
RBE2	530	310	123456	340
RBE2	531	311	123456	341

\$

\$ RIGHT SIDE HORIZONTAL TAIL LEADING EDGE

\$

GRID	1301	0	355.08	525.50	77.36	0
GRID	1302	0	356.17	535.00	79.01	0
GRID	1303	0	357.27	544.50	80.67	0
GRID	1304	0	358.36	554.00	82.33	0

GRID	1305	0	359.46	563.50	83.98	0
GRID	1306	0	360.56	573.00	85.64	0
GRID	1307	0	361.65	582.50	87.30	0
GRID	1308	0	362.75	592.00	88.95	0
GRID	1309	0	363.85	601.50	90.61	0
GRID	1310	0	364.94	611.00	92.27	0
GRID	1311	0	366.04	620.50	93.92	0

\$

\$ DISPLACEMENT OF H-TAIL L.E. IS DEPENDENT ON ELASTIC AXIS

RBE2	1251	301	123456	1301
RBE2	1252	302	123456	1302
RBE2	1253	303	123456	1303
RBE2	1254	304	123456	1304
RBE2	1255	305	123456	1305
RBE2	1256	306	123456	1306
RBE2	1257	307	123456	1307
RBE2	1258	308	123456	1308
RBE2	1259	309	123456	1309
RBE2	1260	310	123456	1310
RBE2	1261	311	123456	1311

\$

\$ DUPLICATE GRIDS FOR HORIZONTAL TAIL LEADING EDGE

\$ THE OUTPUT OF THESE GRIDS WILL BE IN COORD. SYST. 5

GRID	1331	0	355.08	525.50	77.36	5
GRID	1332	0	356.17	535.00	79.01	5
GRID	1333	0	357.27	544.50	80.67	5
GRID	1334	0	358.36	554.00	82.33	5
GRID	1335	0	359.46	563.50	83.98	5
GRID	1336	0	360.56	573.00	85.64	5
GRID	1337	0	361.65	582.50	87.30	5
GRID	1338	0	362.75	592.00	88.95	5
GRID	1339	0	363.85	601.50	90.61	5
GRID	1340	0	364.94	611.00	92.27	5
GRID	1341	0	366.04	620.50	93.92	5

\$ DUPLICATE GRIDS ON H-TAIL LEADING EDGE ARE DEPENDENT ON ELASTIC AXIS

RBE2	541	301	123456	1331
RBE2	542	302	123456	1332
RBE2	543	303	123456	1333
RBE2	544	304	123456	1334
RBE2	545	305	123456	1335
RBE2	546	306	123456	1336
RBE2	547	307	123456	1337
RBE2	548	308	123456	1338
RBE2	549	309	123456	1339
RBE2	550	310	123456	1340
RBE2	551	311	123456	1341

\$

\$ RIGHT SIDE HORIZONTAL TAIL TRAILING EDGE

\$

GRID	2301	0	416.83	525.50	77.36	0
GRID	2302	0	414.84	535.00	79.01	0
GRID	2303	0	412.85	544.50	80.67	0
GRID	2304	0	410.86	554.00	82.33	0
GRID	2305	0	408.87	563.50	83.98	0
GRID	2306	0	406.88	573.00	85.64	0
GRID	2307	0	404.88	582.50	87.30	0
GRID	2308	0	402.89	592.00	88.95	0
GRID	2309	0	400.90	601.50	90.61	0
GRID	2310	0	398.91	611.00	92.27	0
GRID	2311	0	396.92	620.50	93.92	0

\$ DUPLICATE GRIDS FOR HORIZONTAL TAIL TRAILING EDGE

\$ THE OUTPUT FOR THESE GRIDS WILL BE IN COORD. SYST. 5

GRID	2331	0	416.83	525.50	77.36	5
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GRID	2332	0	414.84	535.00	79.01	5
GRID	2333	0	412.85	544.50	80.67	5
GRID	2334	0	410.86	554.00	82.33	5
GRID	2335	0	408.87	563.50	83.98	5
GRID	2336	0	406.88	573.00	85.64	5
GRID	2337	0	404.88	582.50	87.30	5
GRID	2338	0	402.89	592.00	88.95	5
GRID	2339	0	400.90	601.50	90.61	5
GRID	2340	0	398.91	611.00	92.27	5
GRID	2341	0	396.92	620.50	93.92	5

\$ DUPLICATE H-TAIL T.E. GRIDS ARE DEPENDENT ON ORIGINAL T.E. GRIDS

RBE2	561	2301	123456	2331
RBE2	562	2302	123456	2332
RBE2	563	2303	123456	2333
RBE2	564	2304	123456	2334
RBE2	565	2305	123456	2335
RBE2	566	2306	123456	2336
RBE2	567	2307	123456	2337
RBE2	568	2308	123456	2338
RBE2	569	2309	123456	2339
RBE2	570	2310	123456	2340
RBE2	571	2311	123456	2341

\$

\$ GRIDS AT 80% CHORD HINGE-LINE OF RIGHT SIDE HORIZONTAL TAIL

GRID	2501	0	404.480	525.500	77.360	0
GRID	2502	0	403.106	535.000	79.010	0
GRID	2503	0	401.734	544.500	80.670	0
GRID	2504	0	400.360	554.000	82.330	0
GRID	2505	0	398.988	563.500	83.980	0
GRID	2506	0	397.616	573.000	85.640	0
GRID	2507	0	396.234	582.500	87.300	0
GRID	2508	0	394.862	592.000	88.950	0
GRID	2509	0	393.490	601.500	90.610	0
GRID	2510	0	392.116	611.000	92.270	0
GRID	2511	0	390.744	620.500	93.920	0

\$

\$ *****

\$ END OF RIGHT SIDE HORIZONTAL TAIL DEFINITION

\$ *****

\$

\$ *****

\$ RIGHT SIDE VERTICAL TAIL DEFINITION

\$ *****

\$

\$ GRIDS FOR RIGHT SIDE VERTICAL TAIL BEAM

GRID	401	0	410.39	525.50	77.50	0
GRID	402	0	411.39	522.60	85.47	0
GRID	403	0	412.38	519.70	93.44	0
GRID	404	0	413.38	516.80	101.41	0
GRID	405	0	414.37	513.90	109.38	0
GRID	406	0	415.37	511.00	117.34	0
GRID	407	0	416.36	508.10	125.31	0
GRID	408	0	417.36	505.20	133.28	0
GRID	409	0	418.35	502.30	141.25	0
GRID	410	0	419.35	499.40	149.22	0
GRID	411	0	420.34	496.50	157.19	0

\$ THIS GROUP OF GRIDS GENERATES OUTPUT IN COORD. SYSTEM 6

\$ THE Z-AXIS FOR COORD. SYS. 5 IS NORMAL TO PLANE OF V-TAIL

GRID	431	0	410.39	525.50	77.50	6
GRID	432	0	411.39	522.60	85.47	6
GRID	433	0	412.38	519.70	93.44	6
GRID	434	0	413.38	516.80	101.41	6
GRID	435	0	414.37	513.90	109.38	6

GRID	436	0	415.37	511.00	117.34	6
GRID	437	0	416.36	508.10	125.31	6
GRID	438	0	417.36	505.20	133.28	6
GRID	439	0	418.35	502.30	141.25	6
GRID	440	0	419.35	499.40	149.22	6
GRID	441	0	420.34	496.50	157.19	6
\$ DUPLICATE GRIDS OF MAIN V-TAIL ARE DEPENDENT ON ELASTIC AXIS GRIDS						
RBE2	581	401	123456	431		
RBE2	582	402	123456	432		
RBE2	583	403	123456	433		
RBE2	584	404	123456	434		
RBE2	585	405	123456	435		
RBE2	586	406	123456	436		
RBE2	587	407	123456	437		
RBE2	588	408	123456	438		
RBE2	589	409	123456	439		
RBE2	590	410	123456	440		
RBE2	591	411	123456	441		
\$						
\$ RIGHT SIDE VERTICAL TAIL LEADING EDGE						
\$						
GRID	1401	0	390.67	525.50	77.50	0
GRID	1402	0	392.36	522.60	85.47	0
GRID	1403	0	394.05	519.70	93.44	0
GRID	1404	0	395.73	516.80	101.41	0
GRID	1405	0	397.42	513.90	109.38	0
GRID	1406	0	399.11	511.00	117.34	0
GRID	1407	0	400.79	508.10	125.31	0
GRID	1408	0	402.48	505.20	133.28	0
GRID	1409	0	404.17	502.30	141.25	0
GRID	1410	0	405.85	499.40	149.22	0
GRID	1411	0	407.54	496.50	157.19	0
\$						
\$ LEADING EDGE V-TAIL GRIDS ARE DEPENDENT ON ELASTIC AXIS						
RBE2	1271	401	123456	1401		
RBE2	1272	402	123456	1402		
RBE2	1273	403	123456	1403		
RBE2	1274	404	123456	1404		
RBE2	1275	405	123456	1405		
RBE2	1276	406	123456	1406		
RBE2	1277	407	123456	1407		
RBE2	1278	408	123456	1408		
RBE2	1279	409	123456	1409		
RBE2	1280	410	123456	1410		
RBE2	1281	411	123456	1411		
\$						
\$ DUPLICATE GRIDS FOR VERTICAL TAIL LEADING EDGE						
\$ THE OUTPUT OF THESE GRIDS WILL BE IN COORD. SYST. 6						
GRID	1431	0	390.67	525.50	77.50	6
GRID	1432	0	392.36	522.60	85.47	6
GRID	1433	0	394.05	519.70	93.44	6
GRID	1434	0	395.73	516.80	101.41	6
GRID	1435	0	397.42	513.90	109.38	6
GRID	1436	0	399.11	511.00	117.34	6
GRID	1437	0	400.79	508.10	125.31	6
GRID	1438	0	402.48	505.20	133.28	6
GRID	1439	0	404.17	502.30	141.25	6
GRID	1440	0	405.85	499.40	149.22	6
GRID	1441	0	407.54	496.50	157.19	6
\$ V-TAIL LEADING EDGE DUPLICATE GRIDS ARE DEPENDENT ON ELASTIC AXIS GRIDS						
RBE2	601	401	123456	1431		
RBE2	602	402	123456	1432		
RBE2	603	403	123456	1433		

RBE2	604	404	123456	1434
RBE2	605	405	123456	1435
RBE2	606	406	123456	1436
RBE2	607	407	123456	1437
RBE2	608	408	123456	1438
RBE2	609	409	123456	1439
RBE2	610	410	123456	1440
RBE2	611	411	123456	1441

\$

\$ RIGHT SIDE VERTICAL TAIL TRAILING EDGE

\$

GRID	2401	0	439.97	525.50	77.50	0
GRID	2402	0	439.93	522.60	85.47	0
GRID	2403	0	439.89	519.70	93.44	0
GRID	2404	0	439.84	516.80	101.41	0
GRID	2405	0	439.80	513.90	109.38	0
GRID	2406	0	439.76	511.00	117.34	0
GRID	2407	0	439.71	508.10	125.31	0
GRID	2408	0	439.67	505.20	133.28	0
GRID	2409	0	439.63	502.30	141.25	0
GRID	2410	0	439.58	499.40	149.22	0
GRID	2411	0	439.54	496.50	157.19	0

\$ DUPLICATE GRIDS FOR VERTICAL TAIL TRAILING EDGE

\$ THE OUTPUT FOR THESE GRIDS WILL BE IN COORD. SYST. 6

GRID	2431	0	439.97	525.50	77.50	6
GRID	2432	0	439.93	522.60	85.47	6
GRID	2433	0	439.89	519.70	93.44	6
GRID	2434	0	439.84	516.80	101.41	6
GRID	2435	0	439.80	513.90	109.38	6
GRID	2436	0	439.76	511.00	117.34	6
GRID	2437	0	439.71	508.10	125.31	6
GRID	2438	0	439.67	505.20	133.28	6
GRID	2439	0	439.63	502.30	141.25	6
GRID	2440	0	439.58	499.40	149.22	6
GRID	2441	0	439.54	496.50	157.19	6

\$ DUPLICATE V-TAIL T.E. GRIDS ARE DEPENDENT ON ORIGINAL GRIDS

RBE2	621	2401	123456	2431
RBE2	622	2402	123456	2432
RBE2	623	2403	123456	2433
RBE2	624	2404	123456	2434
RBE2	625	2405	123456	2435
RBE2	626	2406	123456	2436
RBE2	627	2407	123456	2437
RBE2	628	2408	123456	2438
RBE2	629	2409	123456	2439
RBE2	630	2410	123456	2440
RBE2	631	2411	123456	2441

\$

\$ GRIDS AT 80% CHORD HINGE-LINE OF RIGHT SIDE VERTICAL TAIL

GRID	2601	0	430.110	525.500	77.500	0
GRID	2602	0	430.416	522.600	85.470	0
GRID	2603	0	430.722	519.700	93.440	0
GRID	2604	0	431.018	516.800	101.410	0
GRID	2605	0	431.324	513.900	109.380	0
GRID	2606	0	431.630	511.000	117.340	0
GRID	2607	0	431.926	508.100	125.310	0
GRID	2608	0	432.232	505.200	133.280	0
GRID	2609	0	432.538	502.300	141.250	0
GRID	2610	0	432.834	499.400	149.220	0
GRID	2611	0	433.140	496.500	157.190	0

\$

\$

\$ *****
END OF RIGHT SIDE VERTICAL TAIL DEFINITION

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$ *****
$
$ MAIN BEAMS FOR RIGHT WING
CBEAM      101      101      101      102      -1.      0.      0.
CBEAM      102      102      102      103      -1.      0.      0.
CBEAM      103      103      103      104      -1.      0.      0.
CBEAM      104      104      104      105      -1.      0.      0.
CBEAM      105      105      105      106      -1.      0.      0.
CBEAM      106      106      106      107      -1.      0.      0.
CBEAM      107      107      107      108      -1.      0.      0.
CBEAM      108      108      108      109      -1.      0.      0.
CBEAM      109      109      109      110      -1.      0.      0.
CBEAM      110      110      110      111      -1.      0.      0.
CBEAM      111      111      111      112      -1.      0.      0.
CBEAM      112      112      112      113      -1.      0.      0.
CBEAM      113      113      113      114      -1.      0.      0.
CBEAM      114      114      114      115      -1.      0.      0.
CBEAM      115      115      115      116      -1.      0.      0.
CBEAM      116      116      116      117      -1.      0.      0.
CBEAM      117      117      117      118      -1.      0.      0.
CBEAM      118      118      118      119      -1.      0.      0.
CBEAM      119      119      119      120      -1.      0.      0.
CBEAM      120      120      120      121      -1.      0.      0.
CBEAM      121      121      121      122      -1.      0.      0.
CBEAM      122      122      122      123      -1.      0.      0.
CBEAM      123      123      123      124      -1.      0.      0.
CBEAM      124      124      124      125      -1.      0.      0.
CBEAM      125      125      125      126      -1.      0.      0.
CBEAM      126      126      126      127      -1.      0.      0.
CBEAM      127      127      127      128      -1.      0.      0.
CBEAM      128      128      128      129      -1.      0.      0.
CBEAM      129      129      129      130      -1.      0.      0.
CBEAM      130      130      130      131      -1.      0.      0.
CBEAM      131      131      131      132      -1.      0.      0.
CBEAM      132      132      132      133      -1.      0.      0.
CBEAM      133      133      133      134      -1.      0.      0.
CBEAM      134      134      134      135      -1.      0.      0.
CBEAM      135      135      135      136      -1.      0.      0.
CBEAM      136      136      136      137      -1.      0.      0.
CBEAM      137      137      137      138      -1.      0.      0.
CBEAM      138      138      138      139      -1.      0.      0.
CBEAM      139      139      139      140      -1.      0.      0.
CBEAM      140      140      140      141      -1.      0.      0.
$ BEAMS FOR RIGHT WING TIP BOOM
CBEAM      201      201      201      202      0.      1.      0.
CBEAM      202      202      202      203      0.      1.      0.
CBEAM      203      203      203      204      0.      1.      0.
CBEAM      204      204      204      205      0.      1.      0.
CBEAM      205      205      205      206      0.      1.      0.
CBEAM      206      206      206      207      0.      1.      0.
CBEAM      207      207      207      208      0.      1.      0.
CBEAM      208      208      208      209      0.      1.      0.
CBEAM      209      209      209      210      0.      1.      0.
CBEAM      210      210      210      211      0.      1.      0.
CBEAM      211      211      211      212      0.      1.      0.
CBEAM      212      212      212      213      0.      1.      0.
CBEAM      213      213      213      214      0.      1.      0.
CBEAM      214      214      214      215      0.      1.      0.
CBEAM      215      215      215      216      0.      1.      0.
CBEAM      216      216      216      217      0.      1.      0.
CBEAM      217      217      217      218      0.      1.      0.
CBEAM      218      218      218      219      0.      1.      0.
CBEAM      219      219      219      220      0.      1.      0.

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CBEAM	220	220	220	221	0.	1.	0.
CBEAM	221	221	221	222	0.	1.	0.
CBEAM	222	222	222	223	0.	1.	0.
CBEAM	223	223	223	224	0.	1.	0.
CBEAM	224	224	224	225	0.	1.	0.
CBEAM	225	225	225	226	0.	1.	0.
CBEAM	226	226	226	227	0.	1.	0.
CBEAM	227	227	227	228	0.	1.	0.
CBEAM	228	228	228	229	0.	1.	0.
CBEAM	229	229	229	230	0.	1.	0.
CBEAM	230	230	230	231	0.	1.	0.
CBEAM	231	231	231	232	0.	1.	0.
CBEAM	232	232	232	233	0.	1.	0.
CBEAM	233	233	233	234	0.	1.	0.
CBEAM	234	234	234	235	0.	1.	0.
CBEAM	235	235	235	236	0.	1.	0.
CBEAM	236	236	236	237	0.	1.	0.
CBEAM	237	237	237	238	0.	1.	0.
CBEAM	238	238	238	239	0.	1.	0.
CBEAM	239	239	239	240	0.	1.	0.
CBEAM	240	240	240	241	0.	1.	0.
CBEAM	241	241	241	242	0.	1.	0.
CBEAM	242	242	242	243	0.	1.	0.

\$ RIGHT SIDE HORIZONTAL TAIL BEAMS

CBEAM	301	301	301	302	-1.	0.	0.
CBEAM	302	302	302	303	-1.	0.	0.
CBEAM	303	303	303	304	-1.	0.	0.
CBEAM	304	304	304	305	-1.	0.	0.
CBEAM	305	305	305	306	-1.	0.	0.
CBEAM	306	306	306	307	-1.	0.	0.
CBEAM	307	307	307	308	-1.	0.	0.
CBEAM	308	308	308	309	-1.	0.	0.
CBEAM	309	309	309	310	-1.	0.	0.
CBEAM	310	310	310	311	-1.	0.	0.

\$ RIGHT SIDE VERTICAL TAIL BEAMS

CBEAM	401	401	401	402	1.	0.	0.
CBEAM	402	402	402	403	1.	0.	0.
CBEAM	403	403	403	404	1.	0.	0.
CBEAM	404	404	404	405	1.	0.	0.
CBEAM	405	405	405	406	1.	0.	0.
CBEAM	406	406	406	407	1.	0.	0.
CBEAM	407	407	407	408	1.	0.	0.
CBEAM	408	408	408	409	1.	0.	0.
CBEAM	409	409	409	410	1.	0.	0.
CBEAM	410	410	410	411	1.	0.	0.

\$

\$ BEAM PROPERTIES FOR RIGHT WING ELASTIC AXIS

PBEAM	101	1	1000.	1021.	247.3	0.	174.3	0.
PBEAM	102	1	1000.	1005.	227.7	0.	171.5	0.
PBEAM	103	1	1000.	989.3	208.8	0.	168.7	0.
PBEAM	104	1	1000.	974.	190.5	0.	166.	0.
PBEAM	105	1	1000.	958.7	173.	0.	163.3	0.
PBEAM	106	1	1000.	943.7	156.2	0.	160.6	0.
PBEAM	107	1	1000.	928.8	140.2	0.	157.9	0.
PBEAM	108	1	1000.	914.	124.8	0.	155.3	0.
PBEAM	109	1	1000.	899.4	110.3	0.	152.7	0.
PBEAM	110	1	1000.	885.	96.95	0.	150.1	0.
PBEAM	111	1	1000.	870.7	92.06	0.	147.6	0.
PBEAM	112	1	1000.	856.6	86.48	0.	145.1	0.
PBEAM	113	1	1000.	842.6	79.99	0.	142.6	0.
PBEAM	114	1	1000.	828.8	75.44	0.	140.1	0.
PBEAM	115	1	1000.	815.2	71.21	0.	137.7	0.
PBEAM	116	1	1000.	801.6	68.65	0.	135.3	0.

PBEAM	117	1	1000.	788.3	67.96	0.	133.	0.
PBEAM	118	1	1000.	769.7	66.91	0.	129.7	0.
PBEAM	119	1	1000.	746.1	65.52	0.	125.5	0.
PBEAM	120	1	1000.	723.1	64.11	0.	121.4	0.
PBEAM	121	1	1000.	700.5	62.75	0.	117.4	0.
PBEAM	122	1	1000.	678.4	61.39	0.	113.5	0.
PBEAM	123	1	1000.	656.7	60.02	0.	109.7	0.
PBEAM	124	1	1000.	635.5	58.67	0.	106.	0.
PBEAM	125	1	1000.	614.8	57.33	0.	102.3	0.
PBEAM	126	1	1000.	594.6	56.01	0.	98.78	0.
PBEAM	127	1	1000.	574.8	54.7	0.	95.3	0.
PBEAM	128	1	1000.	555.4	53.4	0.	91.91	0.
PBEAM	129	1	1000.	536.5	52.12	0.	88.6	0.
PBEAM	130	1	1000.	518.	50.86	0.	85.37	0.
PBEAM	131	1	1000.	499.9	49.61	0.	82.22	0.
PBEAM	132	1	1000.	482.3	48.37	0.	79.15	0.
PBEAM	133	1	1000.	465.1	47.15	0.	76.15	0.
PBEAM	134	1	1000.	448.3	45.95	0.	73.23	0.
PBEAM	135	1	1000.	431.9	44.76	0.	70.39	0.
PBEAM	136	1	1000.	415.9	43.58	0.	67.62	0.
PBEAM	137	1	1000.	400.3	42.42	0.	64.93	0.
PBEAM	138	1	1000.	385.1	41.27	0.	62.3	0.
PBEAM	139	1	1000.	370.3	40.14	0.	59.75	0.
PBEAM	140	1	1000.	355.9	39.03	0.	57.27	0.
\$ BEAM PROPERTIES FOR RIGHT WING TIP BOOM								
PBEAM	201	2	1000.	83.46	90.29	0.	238.6	0.
PBEAM	202	2	1000.	132.9	146.5	0.	238.6	0.
PBEAM	203	2	1000.	182.3	202.8	0.	238.6	0.
PBEAM	204	2	1000.	231.8	259.1	0.	238.6	0.
PBEAM	205	2	1000.	281.2	315.3	0.	238.6	0.
PBEAM	206	2	1000.	330.7	371.6	0.	238.6	0.
PBEAM	207	2	1000.	380.1	427.8	0.	238.6	0.
PBEAM	208	2	1000.	429.5	484.1	0.	238.6	0.
PBEAM	209	2	1000.	479.	540.4	0.	238.6	0.
PBEAM	210	2	1000.	528.4	596.6	0.	238.6	0.
PBEAM	211	2	1000.	577.8	652.9	0.	238.6	0.
PBEAM	212	2	1000.	627.3	709.1	0.	238.6	0.
PBEAM	213	2	1000.	676.7	765.4	0.	238.6	0.
PBEAM	214	2	1000.	726.2	821.7	0.	238.6	0.
PBEAM	215	2	1000.	704.4	793.9	0.	238.6	0.
PBEAM	216	2	1000.	682.7	766.2	0.	238.6	0.
PBEAM	217	2	1000.	661.	738.4	0.	238.6	0.
PBEAM	218	2	1000.	639.3	710.7	0.	238.6	0.
PBEAM	219	2	1000.	597.	659.8	0.	221.1	0.
PBEAM	220	2	1000.	556.2	610.7	0.	204.5	0.
PBEAM	221	2	1000.	516.7	563.3	0.	188.8	0.
PBEAM	222	2	1000.	478.6	517.7	0.	173.9	0.
PBEAM	223	2	1000.	441.9	473.7	0.	159.8	0.
PBEAM	224	2	1000.	406.6	431.5	0.	146.5	0.
PBEAM	225	2	1000.	372.6	391.1	0.	134.	0.
PBEAM	226	2	1000.	340.	352.3	0.	122.1	0.
PBEAM	227	2	1000.	308.8	315.3	0.	111.	0.
PBEAM	228	2	1000.	278.9	279.9	0.	100.6	0.
PBEAM	229	2	1000.	253.6	249.5	0.	113.6	0.
PBEAM	230	2	1000.	226.1	217.3	0.	102.3	0.
PBEAM	231	2	1000.	200.	186.8	0.	91.71	0.
PBEAM	232	2	1000.	177.6	160.2	0.	98.27	0.
PBEAM	233	2	1000.	153.9	132.9	0.	87.36	0.
PBEAM	234	2	1000.	131.7	107.3	0.	77.29	0.
PBEAM	235	2	1000.	112.4	85.01	0.	79.37	0.
PBEAM	236	2	1000.	94.08	64.02	0.	79.38	0.
PBEAM	237	2	1000.	75.6	43.23	0.	69.04	0.
PBEAM	238	2	1000.	59.53	25.2	0.	67.1	0.

PBEAM	239	2	1000.	44.55	8.614	0.	63.92	0.
PBEAM	240	2	1000.	30.7	8.007	0.	59.78	0.
PBEAM	241	2	1000.	14.37	3.655	0.	27.47	0.
PBEAM	242	2	1000.	3.024	3.024	0.	22.9	0.
\$ BEAM PROPERTIES FOR RIGHT SIDE HORIZONTAL TAIL								
PBEAM	301	3	1000.	1047.	54.91	0.	179.	0.
PBEAM	302	3	1000.	894.1	41.7	0.	151.7	0.
PBEAM	303	3	1000.	756.8	30.83	0.	127.4	0.
PBEAM	304	3	1000.	634.3	22.05	0.	105.8	0.
PBEAM	305	3	1000.	525.8	15.11	0.	86.74	0.
PBEAM	306	3	1000.	430.5	9.772	0.	70.15	0.
PBEAM	307	3	1000.	347.4	5.823	0.	55.82	0.
PBEAM	308	3	1000.	275.8	3.046	0.	43.59	0.
PBEAM	309	3	1000.	214.8	1.241	0.	33.28	0.
PBEAM	310	3	1000.	163.5	0.2188	0.	24.75	0.
\$ BEAM PROPERTIES FOR RIGHT SIDE VERTICAL TAIL								
PBEAM	401	4	1000.	542.6	24.42	0.	73.63	0.
PBEAM	402	4	1000.	486.7	18.52	0.	66.03	0.
PBEAM	403	4	1000.	434.7	13.68	0.	58.98	0.
PBEAM	404	4	1000.	386.6	9.785	0.	52.45	0.
PBEAM	405	4	1000.	342.1	6.712	0.	46.42	0.
PBEAM	406	4	1000.	301.3	4.35	0.	40.87	0.
PBEAM	407	4	1000.	263.8	2.599	0.	35.79	0.
PBEAM	408	4	1000.	229.5	1.365	0.	31.14	0.
PBEAM	409	4	1000.	198.4	0.5584	0.	26.91	0.
PBEAM	410	4	1000.	170.2	0.09922	0.	23.09	0.
\$ MATERIAL PROPERTIES								
\$ FEMAP Material 1 : Generic - WING AND CHORDWISE SPINES								
MAT1	11000000.1000000.	0.3	0.	0.	0.	0.		
\$ FEMAP Material 1 : Generic - BOOM								
MAT1	21000000.1000000.	0.3	0.	0.	0.	0.		
\$ FEMAP Material 1 : Generic - HORIZONTAL								
MAT1	31000000.1000000.	0.3	0.	0.	0.	0.		
\$ FEMAP Material 1 : Generic - VERTICAL								
MAT1	41000000.1000000.	0.3	0.	0.	0.	0.		
\$ LUMPED MASSES								
\$ Fuselage Rigid Body Mass (50% for 1/2 symm model)								
\$								
CONM2	601	100	-1	446.1	125.80	0.00	86.1	0 MASS601
+MASS601	2.64E5	0	8.90E5	0	0	6.95E5		
\$ *****								
\$ LUMPED MASSES FOR RIGHT-WING								
\$ *****								
\$ RIGHT WING								
CONM2	602	102	-1	7.91	157.54	6.57	49.16	0 MASS602
CONM2	603	103	-1	7.75	157.67	19.72	49.83	0 MASS603
CONM2	604	104	-1	7.60	157.80	32.87	50.50	0 MASS604
CONM2	605	105	-1	7.45	157.92	46.01	51.17	0 MASS605
CONM2	606	106	-1	7.30	158.05	59.16	51.84	0 MASS606
CONM2	607	107	-1	7.16	158.17	72.31	52.51	0 MASS607
CONM2	608	108	-1	7.03	158.30	85.46	53.17	0 MASS608
CONM2	609	109	-1	6.90	158.42	98.60	53.84	0 MASS609
CONM2	610	110	-1	6.77	158.54	111.75	54.51	0 MASS610
CONM2	611	111	-1	6.66	158.65	124.90	55.18	0 MASS611
CONM2	612	112	-1	6.57	158.71	138.04	55.86	0 MASS612
CONM2	613	113	-1	6.49	158.77	151.19	56.54	0 MASS613
CONM2	614	114	-1	6.41	158.82	164.34	57.22	0 MASS614

CONM2	615	115	-1	6.35	158.83	177.49	57.91	0 MASS615
CONM2	616	116	-1	6.30	158.82	190.63	58.60	0 MASS616
CONM2	617	117	-1	6.26	158.79	203.78	59.29	0 MASS617
CONM2	618	118	-1	6.24	158.74	216.93	59.99	0 MASS618
CONM2	619	119	-1	6.19	158.66	230.07	60.69	0 MASS619

\$

+MASS602	114.0	0	2357.1	0	0	2471.1	
+MASS603	111.7	0	2285.6	0	0	2397.2	
+MASS604	109.4	0	2216.7	0	0	2326.1	
+MASS605	107.3	0	2150.3	0	0	2257.6	
+MASS606	105.2	0	2086.5	0	0	2191.6	
+MASS607	103.2	0	2025.0	0	0	2128.2	
+MASS608	101.2	0	1966.0	0	0	2067.2	
+MASS609	99.4	0	1909.2	0	0	2008.6	
+MASS610	97.6	0	1854.7	0	0	1952.3	
+MASS611	95.9	0	1802.8	0	0	1898.7	
+MASS612	94.6	0	1760.2	0	0	1854.9	
+MASS613	93.4	0	1719.1	0	0	1812.6	
+MASS614	92.3	0	1679.5	0	0	1771.8	
+MASS615	91.5	0	1646.6	0	0	1738.0	
+MASS616	90.7	0	1615.4	0	0	1706.1	
+MASS617	90.2	0	1587.8	0	0	1678.0	
+MASS618	89.8	0	1563.6	0	0	1653.4	
+MASS619	88.9	0	1527.9	0	0	1616.9	

\$

BEGIN FUEL STATIONS

\$

\$ No Fuel

\$

\$CONM2	620	120	-1	6.14	158.56	243.20	61.53	0 MASS620
\$CONM2	621	121	-1	6.10	158.46	256.33	62.23	0 MASS621
\$CONM2	622	122	-1	6.05	158.36	269.46	62.93	0 MASS622
\$CONM2	623	123	-1	6.00	158.26	282.59	63.63	0 MASS623
\$CONM2	624	124	-1	5.95	158.16	295.72	64.33	0 MASS624
\$CONM2	625	125	-1	5.91	158.06	308.85	65.03	0 MASS625
\$CONM2	626	126	-1	5.86	157.96	321.98	65.73	0 MASS626

\$

\$ No Fuel

\$

+\$MASS620	88.3	0	1485.1	0	0	1573.4	
+\$MASS621	87.6	0	1443.1	0	0	1530.7	
+\$MASS622	86.9	0	1402.0	0	0	1488.9	
+\$MASS623	86.2	0	1361.5	0	0	1447.8	
+\$MASS624	85.5	0	1321.9	0	0	1407.5	
+\$MASS625	84.9	0	1283.1	0	0	1367.9	
+\$MASS626	84.2	0	1245.0	0	0	1329.1	

\$

\$ WITH FUEL AT AN ALTITUDE OF 1000 FEET (10/15/98)

\$

CONM2	620	120	-1	25.379	157.65	243.20	61.53	0 MASS620
CONM2	621	121	-1	24.861	157.57	256.33	62.23	0 MASS621
CONM2	622	122	-1	24.348	157.49	269.46	62.93	0 MASS622
CONM2	623	123	-1	23.839	157.41	282.59	63.63	0 MASS623
CONM2	624	124	-1	23.335	157.33	295.72	64.33	0 MASS624
CONM2	625	125	-1	22.839	157.25	308.85	65.03	0 MASS625
CONM2	626	126	-1	22.348	157.17	321.98	65.73	0 MASS626

\$

\$ WITH FUEL AT AN ALTITUDE OF 1000 FEET (10/15/98)

\$

+MASS620	364.62	0	3931.34	0	0	4090.73	
+MASS621	357.16	0	3774.54	0	0	3930.40	

+MASS622	349.80	0	3622.52	0	0	3774.90		
+MASS623	342.48	0	3475.13	0	0	3624.12		
+MASS624	335.29	0	3332.35	0	0	3477.95		
+MASS625	328.15	0	3194.03	0	0	3336.28		
+MASS626	321.10	0	3060.12	0	0	3199.03		
\$								
\$ With Fuel								
\$								
\$ CONM2	620	120	-1	56.86	157.65	243.20	61.53	0 MASS620
\$ CONM2	621	121	-1	55.70	157.57	256.33	62.23	0 MASS621
\$ CONM2	622	122	-1	54.55	157.49	269.46	62.93	0 MASS622
\$ CONM2	623	123	-1	53.41	157.41	282.59	63.63	0 MASS623
\$ CONM2	624	124	-1	52.28	157.33	295.72	64.33	0 MASS624
\$ CONM2	625	125	-1	51.17	157.25	308.85	65.03	0 MASS625
\$ CONM2	626	126	-1	50.07	157.17	321.98	65.73	0 MASS626
\$								
\$ With Fuel								
\$								
\$ +MASS620	816.9	0	8807.9	0	0	9165.0		
\$ +MASS621	800.2	0	8456.6	0	0	8805.8		
\$ +MASS622	783.7	0	8116.0	0	0	8457.4		
\$ +MASS623	767.3	0	7785.8	0	0	8119.6		
\$ +MASS624	751.2	0	7465.9	0	0	7792.1		
\$ +MASS625	735.2	0	7156.0	0	0	7474.7		
\$ +MASS626	719.4	0	6856.0	0	0	7167.2		
\$								
\$ *****								
\$								
\$ END FUEL STATIONS								
\$ *****								
\$								
CONM2	627	127	-1	5.81	157.86	335.11	66.31	0 MASS627
CONM2	628	128	-1	5.76	157.76	348.24	67.01	0 MASS628
CONM2	629	129	-1	5.72	157.66	361.37	67.71	0 MASS629
CONM2	630	130	-1	5.67	157.56	374.50	68.42	0 MASS630
CONM2	631	131	-1	5.62	157.46	387.63	69.12	0 MASS631
CONM2	632	132	-1	5.58	157.37	400.76	69.82	0 MASS632
CONM2	633	133	-1	5.53	157.27	413.89	70.52	0 MASS633
CONM2	634	134	-1	5.48	157.17	427.02	71.23	0 MASS634
CONM2	635	135	-1	5.43	157.07	440.15	71.93	0 MASS635
CONM2	636	136	-1	12.39	155.86	453.28	72.81	0 MASS636
CONM2	637	137	-1	5.34	156.87	466.41	73.33	0 MASS637
CONM2	638	138	-1	12.29	155.76	479.54	74.19	0 MASS638
CONM2	639	139	-1	5.24	156.67	492.67	74.74	0 MASS639
CONM2	640	140	-1	12.20	155.67	505.80	75.58	0 MASS640
CONM2	641	141	-1	5.15	156.47	518.93	76.14	0 MASS641
\$								
+MASS627	83.5	0	1207.6	0	0	1291.1		
+MASS628	82.8	0	1171.0	0	0	1253.8		
+MASS629	82.1	0	1135.2	0	0	1217.3		
+MASS630	81.5	0	1100.0	0	0	1181.5		
+MASS631	80.8	0	1065.6	0	0	1146.4		
+MASS632	80.1	0	1031.9	0	0	1112.0		
+MASS633	79.4	0	999.0	0	0	1078.4		
+MASS634	78.7	0	966.7	0	0	1045.4		
+MASS635	78.1	0	935.1	0	0	1013.2		
+MASS636	77.4	0	974.4	0	0	974.4		
+MASS637	76.7	0	874.0	0	0	950.7		
+MASS638	76.0	0	912.3	0	0	912.3		
+MASS639	75.3	0	815.6	0	0	890.9		
+MASS640	74.7	0	853.1	0	0	853.1		
+MASS641	74.0	0	759.8	0	0	833.8		
\$								
\$ LUMPED MASSES ON RIGHT WING-TIP BOOM								

CONM2	702	202	-1	11.25	33.61	525.50	77.50	0 MASS702
CONM2	703	203	-1	16.33	42.22	525.50	77.50	0 MASS703
CONM2	704	204	-1	16.41	50.83	525.50	77.50	0 MASS704
CONM2	705	205	-1	11.48	59.44	525.50	77.50	0 MASS705
CONM2	706	206	-1	1.56	68.06	525.50	77.50	0 MASS706
CONM2	707	207	-1	1.64	76.67	525.50	77.50	0 MASS707
CONM2	708	208	-1	1.72	85.28	525.50	77.50	0 MASS708
CONM2	709	209	-1	1.79	93.89	525.50	77.50	0 MASS709
CONM2	710	210	-1	1.87	102.50	525.50	77.50	0 MASS710
CONM2	711	211	-1	1.95	111.11	525.50	77.50	0 MASS711
CONM2	712	212	-1	2.02	119.72	525.50	77.50	0 MASS712
CONM2	713	213	-1	2.10	128.33	525.50	77.50	0 MASS713
CONM2	714	214	-1	2.18	136.94	525.50	77.50	0 MASS714
CONM2	715	215	-1	2.25	145.56	525.50	77.50	0 MASS715
CONM2	716	216	-1	2.22	154.17	525.50	77.50	0 MASS716
CONM2	717	217	-1	2.18	162.78	525.50	77.50	0 MASS717
CONM2	718	218	-1	5.65	171.39	525.50	77.50	0 MASS718
CONM2	719	219	-1	2.11	180.00	525.50	77.50	0 MASS719
CONM2	720	220	-1	2.41	190.00	525.50	77.50	0 MASS720
CONM2	721	221	-1	2.35	200.00	525.50	77.50	0 MASS721
CONM2	722	222	-1	2.30	210.00	525.50	77.50	0 MASS722
CONM2	723	223	-1	2.24	220.00	525.50	77.50	0 MASS723
CONM2	724	224	-1	2.17	230.00	525.50	77.50	0 MASS724
CONM2	725	225	-1	2.11	240.00	525.50	77.50	0 MASS725
CONM2	726	226	-1	2.05	250.00	525.50	77.50	0 MASS726
CONM2	727	227	-1	1.98	260.00	525.50	77.50	0 MASS727
CONM2	728	228	-1	1.91	270.00	525.50	77.50	0 MASS728
CONM2	729	229	-1	1.84	280.00	525.50	77.50	0 MASS729
CONM2	730	230	-1	1.89	290.00	525.50	77.50	0 MASS730
CONM2	731	231	-1	1.81	300.00	525.50	77.50	0 MASS731
CONM2	732	232	-1	1.73	310.00	525.50	77.50	0 MASS732
CONM2	733	233	-1	1.76	320.00	525.50	77.50	0 MASS733
CONM2	734	234	-1	1.66	330.00	525.50	77.50	0 MASS734
CONM2	735	235	-1	1.56	340.00	525.50	77.50	0 MASS735
CONM2	736	236	-1	1.56	350.00	525.50	77.50	0 MASS736
CONM2	737	237	-1	1.54	360.00	525.50	77.50	0 MASS737
CONM2	738	238	-1	1.42	370.00	525.50	77.50	0 MASS738
CONM2	739	239	-1	1.37	380.00	525.50	77.50	0 MASS739
CONM2	740	240	-1	1.31	390.00	525.50	77.50	0 MASS740
CONM2	741	241	-1	1.29	400.00	525.50	77.50	0 MASS741
CONM2	742	242	-1	0.80	410.00	525.50	77.50	0 MASS742
CONM2	743	243	-1	0.71	420.00	525.50	77.50	0 MASS743

\$

\$

+MASS702	316.5	0	126.6	0	0	126.6
+MASS703	459.3	0	330.6	0	0	330.6
+MASS704	461.5	0	332.1	0	0	332.1
+MASS705	323.0	0	232.5	0	0	232.5
+MASS706	87.8	0	53.6	0	0	53.6
+MASS707	92.2	0	56.2	0	0	56.2
+MASS708	96.5	0	58.8	0	0	58.8
+MASS709	100.8	0	61.5	0	0	61.5
+MASS710	105.1	0	64.1	0	0	64.1
+MASS711	109.5	0	66.8	0	0	66.8
+MASS712	113.8	0	69.4	0	0	69.4
+MASS713	118.1	0	72.0	0	0	72.0
+MASS714	122.5	0	74.7	0	0	74.7
+MASS715	126.8	0	77.3	0	0	77.3
+MASS716	124.8	0	76.1	0	0	76.1
+MASS717	122.7	0	74.9	0	0	74.9
+MASS718	158.8	0	114.3	0	0	114.3
+MASS719	118.7	0	72.4	0	0	72.4
+MASS720	128.9	0	84.6	0	0	84.6

+MASS721	119.5	0	79.4	0	0	79.4		
+MASS722	110.5	0	74.4	0	0	74.4		
+MASS723	101.8	0	69.6	0	0	69.6		
+MASS724	93.6	0	64.9	0	0	64.9		
+MASS725	85.8	0	60.5	0	0	60.5		
+MASS726	78.3	0	56.2	0	0	56.2		
+MASS727	71.3	0	52.1	0	0	52.1		
+MASS728	64.5	0	48.2	0	0	48.2		
+MASS729	58.2	0	44.4	0	0	44.4		
+MASS730	56.0	0	43.8	0	0	43.8		
+MASS731	50.0	0	40.1	0	0	40.1		
+MASS732	44.3	0	36.6	0	0	36.6		
+MASS733	41.8	0	35.5	0	0	35.5		
+MASS734	36.5	0	32.1	0	0	32.1		
+MASS735	31.6	0	28.8	0	0	28.8		
+MASS736	29.0	0	27.5	0	0	27.5		
+MASS737	26.2	0	26.0	0	0	26.0		
+MASS738	21.9	0	22.8	0	0	22.8		
+MASS739	19.3	0	21.1	0	0	21.1		
+MASS740	16.6	0	19.2	0	0	19.2		
+MASS741	14.7	0	18.1	0	0	18.1		
+MASS742	8.1	0	10.7	0	0	10.7		
+MASS743	6.4	0	9.1	0	0	9.1		
\$ LUMPED MASSES FOR RIGHT SIDE HORIZONTAL TAIL								
CONM2	802	302	-1	4.97	387.10	530.25	77.80	0 MASS802
CONM2	803	303	-1	4.73	386.66	539.75	79.47	0 MASS803
CONM2	804	304	-1	7.69	387.79	549.25	81.06	0 MASS804
CONM2	805	305	-1	4.26	385.75	558.75	82.82	0 MASS805
CONM2	806	306	-1	4.03	385.29	568.25	84.49	0 MASS806
CONM2	807	307	-1	7.00	387.18	577.75	86.04	0 MASS807
CONM2	808	308	-1	3.58	384.33	587.25	87.84	0 MASS808
CONM2	809	309	-1	3.35	383.83	596.75	89.51	0 MASS809
CONM2	810	310	-1	6.34	386.70	606.25	91.01	0 MASS810
CONM2	811	311	-1	2.92	382.81	615.75	92.87	0 MASS811
\$								
+MASS802	37.4	0	1504.7	0	0	1542.1		
+MASS803	35.6	0	1289.2	0	0	1324.7		
+MASS804	33.8	0	1149.5	0	0	1149.5		
+MASS805	32.0	0	923.6	0	0	955.6		
+MASS806	30.3	0	770.9	0	0	801.2		
+MASS807	28.6	0	710.0	0	0	710.0		
+MASS808	26.9	0	519.2	0	0	546.1		
+MASS809	25.2	0	417.6	0	0	442.8		
+MASS810	23.6	0	427.7	0	0	427.7		
+MASS811	22.0	0	256.7	0	0	278.7		
\$ LUMPED MASSES FOR RIGHT SIDE VERTICAL TAIL								
CONM2	902	402	-1	3.06	413.63	524.05	81.48	0 MASS902
CONM2	903	403	-1	2.91	414.65	521.15	89.45	0 MASS903
CONM2	904	404	-1	5.97	418.34	518.25	97.42	0 MASS904
CONM2	905	405	-1	2.63	416.67	515.35	105.39	0 MASS905
CONM2	906	406	-1	2.49	417.67	512.45	113.36	0 MASS906
CONM2	907	407	-1	2.36	418.66	509.55	121.33	0 MASS907
CONM2	908	408	-1	5.43	422.59	506.65	129.30	0 MASS908
CONM2	909	409	-1	2.1	420.61	503.75	137.27	0 MASS909
CONM2	910	410	-1	1.98	421.57	500.85	145.23	0 MASS910
CONM2	911	411	-1	1.86	422.50	497.95	153.20	0 MASS911
\$								
+MASS902	18.3	0	616.3	0	0	597.9		
+MASS903	17.5	0	547.1	0	0	529.7		
+MASS904	16.6	0	483.7	0	0	467.1		
+MASS905	15.8	0	425.8	0	0	410.0		
+MASS906	14.9	0	373.1	0	0	358.2		
+MASS907	14.1	0	325.3	0	0	311.2		

+MASS908	13.3	0	282.3	0	0	269.0
+MASS909	12.6	0	243.7	0	0	231.1
+MASS910	11.8	0	209.3	0	0	197.5
+MASS911	11.1	0	178.9	0	0	167.8

\$

\$

PBEAM	2301	1	100.	1000.	1000.	0.	1000.
PBEAM	2401	1	100.	1000.	1000.	0.	1000.

\$

\$ RIGHT SIDE BEAMS FROM H-TAIL MAIN BEAM TO HINGE LINE

CBEAM	2301	2301	301	2501	302
CBEAM	2302	2301	302	2502	301
CBEAM	2303	2301	303	2503	301
CBEAM	2304	2301	304	2504	301
CBEAM	2305	2301	305	2505	301
CBEAM	2306	2301	306	2506	301
CBEAM	2307	2301	307	2507	301
CBEAM	2308	2301	308	2508	301
CBEAM	2309	2301	309	2509	301
CBEAM	2310	2301	310	2510	301
CBEAM	2311	2301	311	2511	301

\$

\$ RIGHT SIDE BEAMS FROM H-TAIL HINGE LINE TO H-TAIL TRAILING EDGE

CBEAM	2321	2301	2501	2301	2502
CBEAM	2322	2301	2502	2302	2501
CBEAM	2323	2301	2503	2303	2501
CBEAM	2324	2301	2504	2304	2501
CBEAM	2325	2301	2505	2305	2501
CBEAM	2326	2301	2506	2306	2501
CBEAM	2327	2301	2507	2307	2501
CBEAM	2328	2301	2508	2308	2501
CBEAM	2329	2301	2509	2309	2501
CBEAM	2330	2301	2510	2310	2501
CBEAM	2331	2301	2511	2311	2501

\$ RIGHT SIDE BEAMS FROM V-TAIL MAIN BEAM TO HINGE LINE

CBEAM	2401	2401	401	2601	402
CBEAM	2402	2401	402	2602	401
CBEAM	2403	2401	403	2603	401
CBEAM	2404	2401	404	2604	401
CBEAM	2405	2401	405	2605	401
CBEAM	2406	2401	406	2606	401
CBEAM	2407	2401	407	2607	401
CBEAM	2408	2401	408	2608	401
CBEAM	2409	2401	409	2609	401
CBEAM	2410	2401	410	2610	401
CBEAM	2411	2401	411	2611	401

\$

\$ RIGHT SIDE BEAMS FROM V-TAIL HINGE LINE TO V-TAIL TRAILING EDGE

CBEAM	2421	2401	2601	2401	2602
CBEAM	2422	2401	2602	2402	2601
CBEAM	2423	2401	2603	2403	2601
CBEAM	2424	2401	2604	2404	2601
CBEAM	2425	2401	2605	2405	2601
CBEAM	2426	2401	2606	2406	2601
CBEAM	2427	2401	2607	2407	2601
CBEAM	2428	2401	2608	2408	2601
CBEAM	2429	2401	2609	2409	2601
CBEAM	2430	2401	2610	2410	2601
CBEAM	2431	2401	2611	2411	2601

\$

ENDDATA

APPENDIX D

MSC/NASTRAN files used in the frequency response analysis of the two-dimensional gust analysis of the Alliance airplane

- Program gustv5_1.dat

```
$                ERATST PROOF OF CONCEPT AIRPLANE
$ERAST PROOF OF CONCEPT AIRPLANE USING FULL MODEL AND TWO DIMENSIONAL GUST
$
$    FREQUENCY RESPONSE

$    TO EXECUTE THIS FILE USE THE FOLLOWING:
$    NAST705 GUSTV5_1 SCRATCH=YES MEM=12MW NEWS=NO
$
$ASSIGN INPUT4='strip.dat' UNIT=12,FORM=FORMATTED
SOL 146 $ AEROELASTIC DYNAMIC RESPONSE
TIME 500.00 $ TIME IN MINUTES
INCLUDE 'alterv4.dat'
compile fregrs
alter 241 $
putsys (0, 209) $
alter 242 $
putsys (1, 209) $
CEND
TITLE = FULL MODEL * VON KARMAN PSD * M=0.090 * H=1000.0 FT.
SUBTITLE = FUEL 166.95 LB. * V=98.3 FT/SEC
LABEL = GUST SCALE LENGTH=1000 FEET * GUST VELOCITY=1.0 IN/SEC.
$
LINE = 999999
ECHO = NONE
METHOD = 1 $ SINV EIGENVALUE EXTRACTION METHOD
SDAMPING = 25 $ MODAL STRUCTURAL DAMPING (TABDMP1)
FREQUENCY = 41 $ SET OF SOLUTION FORCING FREQUENCIES (FREQ1)
$
SUBCASE 1 $ APPLY VON KARMAN GUST
    PARAM, NSTRIprm, 80
    GUST = 1005 $ GUST SELECTION (GUST) (HAS TO BE 1005)
    DLOAD = 46 $ APPLY LOAD TO EPOINT TO GET PSD OF GUST (RLOAD1)
OUTPUT(XYOUT)
$$$$$$$$$$$$$$$$$$$$
XYPUNCH ELFORCE RESPONSE / 101(4,11)
XYPUNCH ELFORCE RESPONSE / 101(5,12)
XYPUNCH ELFORCE RESPONSE / 101(6,13)
XYPUNCH ELFORCE RESPONSE / 101(7,14)
XYPUNCH ELFORCE RESPONSE / 101(9,16)
XYPUNCH ELFORCE RESPONSE / 140(4,11)
XYPUNCH ELFORCE RESPONSE / 140(5,12)
XYPUNCH ELFORCE RESPONSE / 140(6,13)
XYPUNCH ELFORCE RESPONSE / 140(7,14)
XYPUNCH ELFORCE RESPONSE / 140(9,16)
XYPUNCH ELFORCE RESPONSE / 217(4,11)
XYPUNCH ELFORCE RESPONSE / 217(5,12)
XYPUNCH ELFORCE RESPONSE / 217(6,13)
XYPUNCH ELFORCE RESPONSE / 217(7,14)
XYPUNCH ELFORCE RESPONSE / 217(9,16)
$$$$$$$$$$$$$$$$$$$$
BEGIN BULK
suport,101,123456
include 'stripl440left'
$
```

```

PARAM, LMODES, 64 $ for free-free, 64 NORMAL MODES < 60 Hz
$ CHANGES "WEIGHT" INPUT DATA TO "MASS" DATA
PARAM,WTMASS,0.002588
$
$ REQUESTS MASS PROPERTIES SUMMARY
PARAM,GRDPNT,0
$
$ *****
$ SECTION FOR DYNAMIC RESPONSE TO GUST LOADING
$ *****
$
PARAM, MACH, 0.090 $ DESIRED MACH NUMBER
PARAM, Q, 0.077444 $ DYNAMIC PRESSURE IN PSI AT 1000 FT. (V=1179.6 IN/SEC)
PARAM, GUSTAERO, -1
$
$ STRUCTURAL MODAL DAMPING = 0.02 IN EACH MODE
TABDMP1 25 G +TDMP1
+TDMP1 0.0 0.02 60.0 0.02 ENDT
$
RANDPS 111 1 1 1.0 0.0 121
$ VELOCITY ON 'GUST' MUST BE SAME AS ON 'AERO' INPUT RECORD.
$GUST ID HAS TO BE 1005
GUST 1005 468.4774-4 0.0 1179.6
RLOAD1 46 56 66
DAREA 56 9990 1.0
EPOINT 9990
$
$ TABLED1 PROVIDES FREQUENCY INTERVAL OVER WHICH LOADS ARE GENERATED
TABLED1 66 +TDVK1
+TDVK1 0.0 1.0 40.0 1.0 ENDT
$ SETS OF FREQUENCIES USED IN SOLUTION OF FREQUENCY RESPONSE PROBLEMS
FREQ2 41 0.01 50. 200
$
$ DMIG DEFINES AN EPOINT USED TO OUTPUT THE VON KARMAN PSD
DMIG STIFF 0 6 1 0
DMIG STIFF 9990 0 9990 0 1.0
$
$ AERO. DENSITY UNITS: LB-SEC**2/IN**4 (SEA-LEVEL)
AERO 0 1179.6 54.031.1463-7 0 0
$
$ CREATE TABLE OF MACH NUMBER AND REDUCED FREQ. FOR AERO. CALC.
MKAERO1 0.09 +MK1
+MK1 0.00001 0.005 0.01 0.02 0.04 0.06 0.08 0.1
MKAERO1 0.09 +MK2
+MK2 0.2 0.4 0.6 0.8 1.0 2.0 3.0 4.0
MKAERO1 0.09 +MK3
+MK3 5.0 6.0 7.0 8.0 9.0 10.0
$
PAERO1 1
$
$ INCLUDE THE SPLINE DEFINITIONS
INCLUDE 'full_spline.dat'
$
$ INCLUDE THE AERODYNAMIC MODEL
INCLUDE 'full_aero.dat'
$
EIGR 1 SINV 0.0 60.0 80
$
$ INCLUDE THE STRUCTURAL MODEL
INCLUDE 'full_struc.dat'
$
$ INCLUDE THE MASS DISTRIBUTION FILE
INCLUDE 'full_mass.dat'

```

\$
ENDDATA
\$

• Program full_struc.dat

```
$
$ CREATE A NEW GRID POINT AT THE C.G. FOR THE CURRENT FUEL MASS CONDITION
$ USE A CBEAM TO CONNECT THIS NEW GRID TO GRID 101
GRID      95      0160.9484      0.077.08521      0
CBEAM      95      95      101      95      1.0      0.0      0.0
PBEAM      95      1      100.0      1000.0      1000.0      0.0      1000.0
$
$ DEFINE LOCAL COORDINATE SYSTEMS FOR HORIZONTAL AND VERTICAL TAILS
SPC1, 1, 123456, 30, 40 $ GRIDS 30 AND 40 ONLY USED FOR ORIENTATION
GRID, 30, 0, 379.75, 521.5678, 100.0 $ DEFINES DIRECTION OF Z-AXIS (H-TAIL)
GRID, 40, 0, 410.39, 587.3362, 100.0 $ DEFINES DIRECTION OF Z-AXIS (V-TAIL)
$
$ COORDINATE SYSTEM 12 IS A REFERENCE AXIS SYSTEM FOR STABILITY DERIVATIVES
$ ORIGIN OF COORDINATE SYSTEM 12 IS AT GRID 101
CORD2R      12      0 156.51      0.0 48.98      156.51      0.0      40.0 +CO12
+CO12      140.0      0.0      48.98
$ LOCAL COORD. SYSTEM FOR RIGHT SIDE HORIZONTAL TAIL
CORD1R, 5, 301, 30, 2301 $ Z-AXIS NORMAL TO PLANE OF HORIZ. TAIL
$ LOCAL COORD. SYSTEM FOR RIGHT SIDE VERTICAL TAIL
CORD1R, 6, 401, 40, 2401 $ Z-AXIS NORMAL TO PLANE OF VERT. TAIL
$
$ LOCAL COORDINATE SYSTEM TO DEFINE Y-AXIS OF RIGHT H-TAIL HINGE LINE
CORD2R      13      0 404.480 525.50 77.360 404.480521.5678 100.0 +CO13
+CO13      450.0531.888378.46955
$ LOCAL COORDINATE SYSTEM TO DEFINE Y-AXIS OF RIGHT V-TAIL HINGE LINE
CORD2R      14      0 433.14 496.50 157.190 433.140614.1537 200.0 +CO14
+CO14      500.0497.3168154.9451
$
$ LOCAL COORD. SYSTEM TO DEFINE Y-AXIS OF LEFT H-TAIL HINGE LINE
CORD2R      15      0 390.744 -620.50 93.920 390.744 -619.444 100.0 +CO15
+CO15      450.0 -628.81695.36436
$ LOCAL COORD. SYSTEM TO DEFINE Y-AXIS OF LEFT V-TAIL HINGE LINE
CORD2R      16      0 430.110 -525.50 77.500 430.110 -587.336 100.0 +CO16
+CO16      450.0 -525.74376.83217
$
CORD2C      1      0      0.      0.      0.      0.      0.      1.+FEMAPC1
+FEMAPC1      1.      0.      1.
CORD2S      2      0      0.      0.      0.      0.      0.      1.+FEMAPC2
+FEMAPC2      1.      0.      1.
$
$ *****
$ BEAM PROPERTIES FOR RIGHT WING (ALSO LEFT WING) ELASTIC AXIS
PBEAM      101      1      1000.      1021.      247.3      0.      174.3      0.
PBEAM      102      1      1000.      1005.      227.7      0.      171.5      0.
PBEAM      103      1      1000.      989.3      208.8      0.      168.7      0.
PBEAM      104      1      1000.      974.      190.5      0.      166.      0.
PBEAM      105      1      1000.      958.7      173.      0.      163.3      0.
PBEAM      106      1      1000.      943.7      156.2      0.      160.6      0.
PBEAM      107      1      1000.      928.8      140.2      0.      157.9      0.
PBEAM      108      1      1000.      914.      124.8      0.      155.3      0.
PBEAM      109      1      1000.      899.4      110.3      0.      152.7      0.
PBEAM      110      1      1000.      885.      96.95      0.      150.1      0.
PBEAM      111      1      1000.      870.7      92.06      0.      147.6      0.
PBEAM      112      1      1000.      856.6      86.48      0.      145.1      0.
PBEAM      113      1      1000.      842.6      79.99      0.      142.6      0.
PBEAM      114      1      1000.      828.8      75.44      0.      140.1      0.
PBEAM      115      1      1000.      815.2      71.21      0.      137.7      0.
```

PBEAM	116	1	1000.	801.6	68.65	0.	135.3	0.
PBEAM	117	1	1000.	788.3	67.96	0.	133.	0.
PBEAM	118	1	1000.	769.7	66.91	0.	129.7	0.
PBEAM	119	1	1000.	746.1	65.52	0.	125.5	0.
PBEAM	120	1	1000.	723.1	64.11	0.	121.4	0.
PBEAM	121	1	1000.	700.5	62.75	0.	117.4	0.
PBEAM	122	1	1000.	678.4	61.39	0.	113.5	0.
PBEAM	123	1	1000.	656.7	60.02	0.	109.7	0.
PBEAM	124	1	1000.	635.5	58.67	0.	106.	0.
PBEAM	125	1	1000.	614.8	57.33	0.	102.3	0.
PBEAM	126	1	1000.	594.6	56.01	0.	98.78	0.
PBEAM	127	1	1000.	574.8	54.7	0.	95.3	0.
PBEAM	128	1	1000.	555.4	53.4	0.	91.91	0.
PBEAM	129	1	1000.	536.5	52.12	0.	88.6	0.
PBEAM	130	1	1000.	518.	50.86	0.	85.37	0.
PBEAM	131	1	1000.	499.9	49.61	0.	82.22	0.
PBEAM	132	1	1000.	482.3	48.37	0.	79.15	0.
PBEAM	133	1	1000.	465.1	47.15	0.	76.15	0.
PBEAM	134	1	1000.	448.3	45.95	0.	73.23	0.
PBEAM	135	1	1000.	431.9	44.76	0.	70.39	0.
PBEAM	136	1	1000.	415.9	43.58	0.	67.62	0.
PBEAM	137	1	1000.	400.3	42.42	0.	64.93	0.
PBEAM	138	1	1000.	385.1	41.27	0.	62.3	0.
PBEAM	139	1	1000.	370.3	40.14	0.	59.75	0.
PBEAM	140	1	1000.	355.9	39.03	0.	57.27	0.
\$ BEAM PROPERTIES FOR RIGHT WING (ALSO LEFT WING) TIP BOOM								
PBEAM	201	2	1000.	83.46	90.29	0.	238.6	0.
PBEAM	202	2	1000.	132.9	146.5	0.	238.6	0.
PBEAM	203	2	1000.	182.3	202.8	0.	238.6	0.
PBEAM	204	2	1000.	231.8	259.1	0.	238.6	0.
PBEAM	205	2	1000.	281.2	315.3	0.	238.6	0.
PBEAM	206	2	1000.	330.7	371.6	0.	238.6	0.
PBEAM	207	2	1000.	380.1	427.8	0.	238.6	0.
PBEAM	208	2	1000.	429.5	484.1	0.	238.6	0.
PBEAM	209	2	1000.	479.	540.4	0.	238.6	0.
PBEAM	210	2	1000.	528.4	596.6	0.	238.6	0.
PBEAM	211	2	1000.	577.8	652.9	0.	238.6	0.
PBEAM	212	2	1000.	627.3	709.1	0.	238.6	0.
PBEAM	213	2	1000.	676.7	765.4	0.	238.6	0.
PBEAM	214	2	1000.	726.2	821.7	0.	238.6	0.
PBEAM	215	2	1000.	704.4	793.9	0.	238.6	0.
PBEAM	216	2	1000.	682.7	766.2	0.	238.6	0.
PBEAM	217	2	1000.	661.	738.4	0.	238.6	0.
PBEAM	218	2	1000.	639.3	710.7	0.	238.6	0.
PBEAM	219	2	1000.	597.	659.8	0.	221.1	0.
PBEAM	220	2	1000.	556.2	610.7	0.	204.5	0.
PBEAM	221	2	1000.	516.7	563.3	0.	188.8	0.
PBEAM	222	2	1000.	478.6	517.7	0.	173.9	0.
PBEAM	223	2	1000.	441.9	473.7	0.	159.8	0.
PBEAM	224	2	1000.	406.6	431.5	0.	146.5	0.
PBEAM	225	2	1000.	372.6	391.1	0.	134.	0.
PBEAM	226	2	1000.	340.	352.3	0.	122.1	0.
PBEAM	227	2	1000.	308.8	315.3	0.	111.	0.
PBEAM	228	2	1000.	278.9	279.9	0.	100.6	0.
PBEAM	229	2	1000.	253.6	249.5	0.	113.6	0.
PBEAM	230	2	1000.	226.1	217.3	0.	102.3	0.
PBEAM	231	2	1000.	200.	186.8	0.	91.71	0.
PBEAM	232	2	1000.	177.6	160.2	0.	98.27	0.
PBEAM	233	2	1000.	153.9	132.9	0.	87.36	0.
PBEAM	234	2	1000.	131.7	107.3	0.	77.29	0.
PBEAM	235	2	1000.	112.4	85.01	0.	79.37	0.
PBEAM	236	2	1000.	94.08	64.02	0.	79.38	0.
PBEAM	237	2	1000.	75.6	43.23	0.	69.04	0.

PBEAM	238	2	1000.	59.53	25.2	0.	67.1	0.
PBEAM	239	2	1000.	44.55	8.614	0.	63.92	0.
PBEAM	240	2	1000.	30.7	8.007	0.	59.78	0.
PBEAM	241	2	1000.	14.37	3.655	0.	27.47	0.
PBEAM	242	2	1000.	3.024	3.024	0.	22.9	0.
\$ BEAM PROPERTIES FOR RIGHT SIDE (ALSO LEFT SIDE) HORIZONTAL TAIL								
PBEAM	301	3	1000.	1047.	54.91	0.	179.	0.
PBEAM	302	3	1000.	894.1	41.7	0.	151.7	0.
PBEAM	303	3	1000.	756.8	30.83	0.	127.4	0.
PBEAM	304	3	1000.	634.3	22.05	0.	105.8	0.
PBEAM	305	3	1000.	525.8	15.11	0.	86.74	0.
PBEAM	306	3	1000.	430.5	9.772	0.	70.15	0.
PBEAM	307	3	1000.	347.4	5.823	0.	55.82	0.
PBEAM	308	3	1000.	275.8	3.046	0.	43.59	0.
PBEAM	309	3	1000.	214.8	1.241	0.	33.28	0.
PBEAM	310	3	1000.	163.5	0.2188	0.	24.75	0.
\$								
PBEAM	2301	1	100.	1000.	1000.	0.	1000.	
\$								
\$ BEAM PROPERTIES FOR RIGHT SIDE (ALSO LEFT SIDE) VERTICAL TAIL								
PBEAM	401	4	1000.	542.6	24.42	0.	73.63	0.
PBEAM	402	4	1000.	486.7	18.52	0.	66.03	0.
PBEAM	403	4	1000.	434.7	13.68	0.	58.98	0.
PBEAM	404	4	1000.	386.6	9.785	0.	52.45	0.
PBEAM	405	4	1000.	342.1	6.712	0.	46.42	0.
PBEAM	406	4	1000.	301.3	4.35	0.	40.87	0.
PBEAM	407	4	1000.	263.8	2.599	0.	35.79	0.
PBEAM	408	4	1000.	229.5	1.365	0.	31.14	0.
PBEAM	409	4	1000.	198.4	0.5584	0.	26.91	0.
PBEAM	410	4	1000.	170.2	0.09922	0.	23.09	0.
\$								
PBEAM	2401	1	100.	1000.	1000.	0.	1000.	
\$								
\$ FEMAP Material 1 : Generic - WING AND CHORDWISE SPINES								
MAT1	11000000.1000000.		0.3	0.	0.		0.	
\$								
\$ FEMAP Material 1 : Generic - BOOM								
MAT1	21000000.1000000.		0.3	0.	0.		0.	
\$								
\$ FEMAP Material 1 : Generic - HORIZONTAL								
MAT1	31000000.1000000.		0.3	0.	0.		0.	
\$								
\$ FEMAP Material 1 : Generic - VERTICAL								
MAT1	41000000.1000000.		0.3	0.	0.		0.	
\$								
\$ GRID 100 REPRESENTS PROPULSION SYSTEM								
RBE2	504	101	123456	100				
\$								
\$ CONNECTIONS TO WING-TIP BOOM, HORIZ. AND VERT. TAILS ON RIGHT SIDE								
RBE2	501	141	123456	216				
RBE2	502	238	123456	301				
RBE2	503	240	123456	401				
\$								
GRID	100	0	125.8	0.0	86.1	0		
\$								
\$ GRIDS FOR RIGHT WING BEAM								
\$								
GRID	101	0	156.51	0.00	48.98	0		
GRID	102	0	156.48	13.15	49.67	0		
GRID	103	0	156.45	26.29	50.37	0		
GRID	104	0	156.41	39.44	51.06	0		
GRID	105	0	156.38	52.59	51.75	0		
GRID	106	0	156.34	65.74	52.45	0		

GRID	107	0	156.31	78.88	53.14	0
GRID	108	0	156.28	92.03	53.83	0
GRID	109	0	156.24	105.18	54.53	0
GRID	110	0	156.21	118.32	55.22	0
GRID	111	0	156.18	131.47	55.91	0
GRID	112	0	156.14	144.62	56.61	0
GRID	113	0	156.11	157.76	57.30	0
GRID	114	0	156.08	170.91	57.99	0
GRID	115	0	156.04	184.06	58.69	0
GRID	116	0	156.01	197.21	59.38	0
GRID	117	0	155.98	210.35	60.07	0
GRID	118	0	155.94	223.50	60.77	0
GRID	119	0	155.88	236.63	61.46	0
GRID	120	0	155.82	249.76	62.16	0
GRID	121	0	155.76	262.89	62.86	0
GRID	122	0	155.70	276.02	63.55	0
GRID	123	0	155.64	289.15	64.25	0
GRID	124	0	155.58	302.28	64.95	0
GRID	125	0	155.52	315.41	65.64	0
GRID	126	0	155.46	328.54	66.34	0
GRID	127	0	155.39	341.67	67.04	0
GRID	128	0	155.33	354.80	67.73	0
GRID	129	0	155.27	367.93	68.43	0
GRID	130	0	155.21	381.07	69.13	0
GRID	131	0	155.15	394.20	69.82	0
GRID	132	0	155.09	407.33	70.52	0
GRID	133	0	155.03	420.46	71.22	0
GRID	134	0	154.97	433.59	71.91	0
GRID	135	0	154.91	446.72	72.61	0
GRID	136	0	154.85	459.85	73.31	0
GRID	137	0	154.79	472.98	74.00	0
GRID	138	0	154.72	486.11	74.70	0
GRID	139	0	154.66	499.24	75.40	0
GRID	140	0	154.60	512.37	76.09	0
GRID	141	0	154.54	525.50	76.79	0

\$

\$ RIGHT SIDE WING SURFACE LEADING-EDGE GRID POINTS

\$

GRID	1101	0	132.83	0.00	48.98	0
GRID	1102	0	132.92	13.15	49.67	0
GRID	1103	0	133.01	26.29	50.37	0
GRID	1104	0	133.10	39.44	51.06	0
GRID	1105	0	133.18	52.59	51.75	0
GRID	1106	0	133.27	65.74	52.45	0
GRID	1107	0	133.36	78.88	53.14	0
GRID	1108	0	133.45	92.03	53.83	0
GRID	1109	0	133.54	105.18	54.53	0
GRID	1110	0	133.63	118.32	55.22	0
GRID	1111	0	133.71	131.47	55.91	0
GRID	1112	0	133.80	144.62	56.61	0
GRID	1113	0	133.89	157.76	57.30	0
GRID	1114	0	133.98	170.91	57.99	0
GRID	1115	0	134.07	184.06	58.69	0
GRID	1116	0	134.16	197.21	59.38	0
GRID	1117	0	134.24	210.35	60.07	0
GRID	1118	0	134.33	223.50	60.77	0
GRID	1119	0	134.49	236.63	61.46	0
GRID	1120	0	134.65	249.76	62.16	0
GRID	1121	0	134.81	262.89	62.86	0
GRID	1122	0	134.97	276.02	63.55	0
GRID	1123	0	135.14	289.15	64.25	0
GRID	1124	0	135.30	302.28	64.95	0
GRID	1125	0	135.46	315.41	65.64	0

GRID	1126	0	135.62	328.54	66.34	0
GRID	1127	0	135.78	341.67	67.04	0
GRID	1128	0	135.94	354.80	67.73	0
GRID	1129	0	136.10	367.93	68.43	0
GRID	1130	0	136.26	381.07	69.13	0
GRID	1131	0	136.42	394.20	69.82	0
GRID	1132	0	136.58	407.33	70.52	0
GRID	1133	0	136.74	420.46	71.22	0
GRID	1134	0	136.90	433.59	71.91	0
GRID	1135	0	137.06	446.72	72.61	0
GRID	1136	0	137.22	459.85	73.31	0
GRID	1137	0	137.38	472.98	74.00	0
GRID	1138	0	137.55	486.11	74.70	0
GRID	1139	0	137.71	499.24	75.40	0
GRID	1140	0	137.87	512.37	76.09	0
GRID	1141	0	138.03	525.50	76.79	0

\$

\$ RIGHT SIDE WING SURFACE TRAILING-EDGE GRID POINTS

\$

GRID	2101	0	192.03	0.00	48.98	0
GRID	2102	0	191.82	13.15	49.67	0
GRID	2103	0	191.60	26.29	50.37	0
GRID	2104	0	191.39	39.44	51.06	0
GRID	2105	0	191.17	52.59	51.75	0
GRID	2106	0	190.95	65.74	52.45	0
GRID	2107	0	190.74	78.88	53.14	0
GRID	2108	0	190.52	92.03	53.83	0
GRID	2109	0	190.30	105.18	54.53	0
GRID	2110	0	190.09	118.32	55.22	0
GRID	2111	0	189.87	131.47	55.91	0
GRID	2112	0	189.66	144.62	56.61	0
GRID	2113	0	189.44	157.76	57.30	0
GRID	2114	0	189.22	170.91	57.99	0
GRID	2115	0	189.01	184.06	58.69	0
GRID	2116	0	188.79	197.21	59.38	0
GRID	2117	0	188.58	210.35	60.07	0
GRID	2118	0	188.36	223.50	60.77	0
GRID	2119	0	187.97	236.63	61.46	0
GRID	2120	0	187.57	249.76	62.16	0
GRID	2121	0	187.18	262.89	62.86	0
GRID	2122	0	186.79	276.02	63.55	0
GRID	2123	0	186.39	289.15	64.25	0
GRID	2124	0	186.00	302.28	64.95	0
GRID	2125	0	185.61	315.41	65.64	0
GRID	2126	0	185.21	328.54	66.34	0
GRID	2127	0	184.82	341.67	67.04	0
GRID	2128	0	184.43	354.80	67.73	0
GRID	2129	0	184.03	367.93	68.43	0
GRID	2130	0	183.64	381.07	69.13	0
GRID	2131	0	183.25	394.20	69.82	0
GRID	2132	0	182.85	407.33	70.52	0
GRID	2133	0	182.46	420.46	71.22	0
GRID	2134	0	182.07	433.59	71.91	0
GRID	2135	0	181.67	446.72	72.61	0
GRID	2136	0	181.28	459.85	73.31	0
GRID	2137	0	180.89	472.98	74.00	0
GRID	2138	0	180.49	486.11	74.70	0
GRID	2139	0	180.10	499.24	75.40	0
GRID	2140	0	179.71	512.37	76.09	0
GRID	2141	0	179.31	525.50	76.79	0

\$

\$ RIGHT WING * LEADING AND TRAILING EDGE GRIDS ARE DEPENDENT ON MAIN BEAM

\$

RBE2	1201	101	123456	1101	2101
RBE2	1202	102	123456	1102	2102
RBE2	1203	103	123456	1103	2103
RBE2	1204	104	123456	1104	2104
RBE2	1205	105	123456	1105	2105
RBE2	1206	106	123456	1106	2106
RBE2	1207	107	123456	1107	2107
RBE2	1208	108	123456	1108	2108
RBE2	1209	109	123456	1109	2109
RBE2	1210	110	123456	1110	2110
RBE2	1211	111	123456	1111	2111
RBE2	1212	112	123456	1112	2112
RBE2	1213	113	123456	1113	2113
RBE2	1214	114	123456	1114	2114
RBE2	1215	115	123456	1115	2115
RBE2	1216	116	123456	1116	2116
RBE2	1217	117	123456	1117	2117
RBE2	1218	118	123456	1118	2118
RBE2	1219	119	123456	1119	2119
RBE2	1220	120	123456	1120	2120
RBE2	1221	121	123456	1121	2121
RBE2	1222	122	123456	1122	2122
RBE2	1223	123	123456	1123	2123
RBE2	1224	124	123456	1124	2124
RBE2	1225	125	123456	1125	2125
RBE2	1226	126	123456	1126	2126
RBE2	1227	127	123456	1127	2127
RBE2	1228	128	123456	1128	2128
RBE2	1229	129	123456	1129	2129
RBE2	1230	130	123456	1130	2130
RBE2	1231	131	123456	1131	2131
RBE2	1232	132	123456	1132	2132
RBE2	1233	133	123456	1133	2133
RBE2	1234	134	123456	1134	2134
RBE2	1235	135	123456	1135	2135
RBE2	1236	136	123456	1136	2136
RBE2	1237	137	123456	1137	2137
RBE2	1238	138	123456	1138	2138
RBE2	1239	139	123456	1139	2139
RBE2	1240	140	123456	1140	2140
RBE2	1241	141	123456	1141	2141

\$

\$ GRIDS FOR RIGHT SIDE WING-TIP BOOM

\$

GRID	201	0	25.	525.5	77.5	0
GRID	202	0	33.6111	525.5	77.5	0
GRID	203	0	42.2222	525.5	77.5	0
GRID	204	0	50.8333	525.5	77.5	0
GRID	205	0	59.4444	525.5	77.5	0
GRID	206	0	68.0556	525.5	77.5	0
GRID	207	0	76.6667	525.5	77.5	0
GRID	208	0	85.2778	525.5	77.5	0
GRID	209	0	93.8889	525.5	77.5	0
GRID	210	0	102.5	525.5	77.5	0
GRID	211	0	111.111	525.5	77.5	0
GRID	212	0	119.722	525.5	77.5	0
GRID	213	0	128.333	525.5	77.5	0
GRID	214	0	136.944	525.5	77.5	0
GRID	215	0	145.556	525.5	77.5	0
GRID	216	0	154.167	525.5	77.5	0
GRID	217	0	162.778	525.5	77.5	0
GRID	218	0	171.389	525.5	77.5	0
GRID	219	0	180.	525.5	77.5	0

GRID	220	0	190.	525.5	77.5	0
GRID	221	0	200.	525.5	77.5	0
GRID	222	0	210.	525.5	77.5	0
GRID	223	0	220.	525.5	77.5	0
GRID	224	0	230.	525.5	77.5	0
GRID	225	0	240.	525.5	77.5	0
GRID	226	0	250.	525.5	77.5	0
GRID	227	0	260.	525.5	77.5	0
GRID	228	0	270.	525.5	77.5	0
GRID	229	0	280.	525.5	77.5	0
GRID	230	0	290.	525.5	77.5	0
GRID	231	0	300.	525.5	77.5	0
GRID	232	0	310.	525.5	77.5	0
GRID	233	0	320.	525.5	77.5	0
GRID	234	0	330.	525.5	77.5	0
GRID	235	0	340.	525.5	77.5	0
GRID	236	0	350.	525.5	77.5	0
GRID	237	0	360.	525.5	77.5	0
GRID	238	0	370.	525.5	77.5	0
GRID	239	0	380.	525.5	77.5	0
GRID	240	0	390.	525.5	77.5	0
GRID	241	0	400.	525.5	77.5	0
GRID	242	0	410.	525.5	77.5	0
GRID	243	0	420.	525.5	77.5	0

\$

\$ *****

\$ RIGHT SIDE HORIZONTAL TAIL DEFINITION

\$ *****

\$ GRIDS FOR RIGHT SIDE HORIZONTAL TAIL BEAM

\$

GRID	301	0	379.75	525.50	77.36	0
GRID	302	0	379.61	535.00	79.01	0
GRID	303	0	379.47	544.50	80.67	0
GRID	304	0	379.34	554.00	82.33	0
GRID	305	0	379.20	563.50	83.98	0
GRID	306	0	379.06	573.00	85.64	0
GRID	307	0	378.92	582.50	87.30	0
GRID	308	0	378.79	592.00	88.95	0
GRID	309	0	378.65	601.50	90.61	0
GRID	310	0	378.51	611.00	92.27	0
GRID	311	0	378.37	620.50	93.92	0

\$ DUPLICATE GRIDS FOR HORIZONTAL TAIL MAIN BEAM

\$ THE OUTPUT OF THESE GRIDS WILL BE IN COORD. SYST. 5

GRID	331	0	379.75	525.50	77.36	5
GRID	332	0	379.61	535.00	79.01	5
GRID	333	0	379.47	544.50	80.67	5
GRID	334	0	379.34	554.00	82.33	5
GRID	335	0	379.20	563.50	83.98	5
GRID	336	0	379.06	573.00	85.64	5
GRID	337	0	378.92	582.50	87.30	5
GRID	338	0	378.79	592.00	88.95	5
GRID	339	0	378.65	601.50	90.61	5
GRID	340	0	378.51	611.00	92.27	5
GRID	341	0	378.37	620.50	93.92	5

\$ DUPLICATE GRIDS ON H-TAIL ARE DEPENDENT ON ELASTIC AXIS BEAM

RBE2	521	301	123456	331
RBE2	522	302	123456	332
RBE2	523	303	123456	333
RBE2	524	304	123456	334
RBE2	525	305	123456	335
RBE2	526	306	123456	336
RBE2	527	307	123456	337
RBE2	528	308	123456	338

RBE2	529	309	123456	339
RBE2	530	310	123456	340
RBE2	531	311	123456	341

\$

\$ RIGHT SIDE HORIZONTAL TAIL LEADING EDGE

\$

GRID	1301	0	355.08	525.50	77.36	0
GRID	1302	0	356.17	535.00	79.01	0
GRID	1303	0	357.27	544.50	80.67	0
GRID	1304	0	358.36	554.00	82.33	0
GRID	1305	0	359.46	563.50	83.98	0
GRID	1306	0	360.56	573.00	85.64	0
GRID	1307	0	361.65	582.50	87.30	0
GRID	1308	0	362.75	592.00	88.95	0
GRID	1309	0	363.85	601.50	90.61	0
GRID	1310	0	364.94	611.00	92.27	0
GRID	1311	0	366.04	620.50	93.92	0

\$

\$ DISPLACEMENT OF H-TAIL L.E. IS DEPENDENT ON ELASTIC AXIS

RBE2	1251	301	123456	1301
RBE2	1252	302	123456	1302
RBE2	1253	303	123456	1303
RBE2	1254	304	123456	1304
RBE2	1255	305	123456	1305
RBE2	1256	306	123456	1306
RBE2	1257	307	123456	1307
RBE2	1258	308	123456	1308
RBE2	1259	309	123456	1309
RBE2	1260	310	123456	1310
RBE2	1261	311	123456	1311

\$

\$ DUPLICATE GRIDS FOR HORIZONTAL TAIL LEADING EDGE

\$ THE OUTPUT OF THESE GRIDS WILL BE IN COORD. SYST. 5

GRID	1331	0	355.08	525.50	77.36	5
GRID	1332	0	356.17	535.00	79.01	5
GRID	1333	0	357.27	544.50	80.67	5
GRID	1334	0	358.36	554.00	82.33	5
GRID	1335	0	359.46	563.50	83.98	5
GRID	1336	0	360.56	573.00	85.64	5
GRID	1337	0	361.65	582.50	87.30	5
GRID	1338	0	362.75	592.00	88.95	5
GRID	1339	0	363.85	601.50	90.61	5
GRID	1340	0	364.94	611.00	92.27	5
GRID	1341	0	366.04	620.50	93.92	5

\$ DUPLICATE GRIDS ON H-TAIL LEADING EDGE ARE DEPENDENT ON ELASTIC AXIS

RBE2	541	301	123456	1331
RBE2	542	302	123456	1332
RBE2	543	303	123456	1333
RBE2	544	304	123456	1334
RBE2	545	305	123456	1335
RBE2	546	306	123456	1336
RBE2	547	307	123456	1337
RBE2	548	308	123456	1338
RBE2	549	309	123456	1339
RBE2	550	310	123456	1340
RBE2	551	311	123456	1341

\$

\$ RIGHT SIDE HORIZONTAL TAIL TRAILING EDGE

\$

GRID	2301	0	416.83	525.50	77.36	0
GRID	2302	0	414.84	535.00	79.01	0
GRID	2303	0	412.85	544.50	80.67	0
GRID	2304	0	410.86	554.00	82.33	0

GRID	2305	0	408.87	563.50	83.98	0
GRID	2306	0	406.88	573.00	85.64	0
GRID	2307	0	404.88	582.50	87.30	0
GRID	2308	0	402.89	592.00	88.95	0
GRID	2309	0	400.90	601.50	90.61	0
GRID	2310	0	398.91	611.00	92.27	0
GRID	2311	0	396.92	620.50	93.92	0

\$ DUPLICATE GRIDS FOR HORIZONTAL TAIL TRAILING EDGE
 \$ THE OUTPUT FOR THESE GRIDS WILL BE IN COORD. SYST. 5

GRID	2331	0	416.83	525.50	77.36	5
GRID	2332	0	414.84	535.00	79.01	5
GRID	2333	0	412.85	544.50	80.67	5
GRID	2334	0	410.86	554.00	82.33	5
GRID	2335	0	408.87	563.50	83.98	5
GRID	2336	0	406.88	573.00	85.64	5
GRID	2337	0	404.88	582.50	87.30	5
GRID	2338	0	402.89	592.00	88.95	5
GRID	2339	0	400.90	601.50	90.61	5
GRID	2340	0	398.91	611.00	92.27	5
GRID	2341	0	396.92	620.50	93.92	5

\$ DUPLICATE H-TAIL T.E. GRIDS ARE DEPENDENT ON ORIGINAL T.E. GRIDS

RBE2	561	2301	123456	2331
RBE2	562	2302	123456	2332
RBE2	563	2303	123456	2333
RBE2	564	2304	123456	2334
RBE2	565	2305	123456	2335
RBE2	566	2306	123456	2336
RBE2	567	2307	123456	2337
RBE2	568	2308	123456	2338
RBE2	569	2309	123456	2339
RBE2	570	2310	123456	2340
RBE2	571	2311	123456	2341

\$
 \$ GRIDS AT 80% CHORD HINGE-LINE OF RIGHT SIDE HORIZONTAL TAIL

GRID	2501	0	404.480	525.500	77.360	0
GRID	2502	0	403.106	535.000	79.010	0
GRID	2503	0	401.734	544.500	80.670	0
GRID	2504	0	400.360	554.000	82.330	0
GRID	2505	0	398.988	563.500	83.980	0
GRID	2506	0	397.616	573.000	85.640	0
GRID	2507	0	396.234	582.500	87.300	0
GRID	2508	0	394.862	592.000	88.950	0
GRID	2509	0	393.490	601.500	90.610	0
GRID	2510	0	392.116	611.000	92.270	0
GRID	2511	0	390.744	620.500	93.920	0

\$
 \$ *****
 \$ END OF RIGHT SIDE HORIZONTAL TAIL DEFINITION
 \$ *****
 \$
 \$ *****
 \$ RIGHT SIDE VERTICAL TAIL DEFINITION
 \$ *****
 \$
 \$ GRIDS FOR RIGHT SIDE VERTICAL TAIL BEAM

GRID	401	0	410.39	525.50	77.50	0
GRID	402	0	411.39	522.60	85.47	0
GRID	403	0	412.38	519.70	93.44	0
GRID	404	0	413.38	516.80	101.41	0
GRID	405	0	414.37	513.90	109.38	0
GRID	406	0	415.37	511.00	117.34	0
GRID	407	0	416.36	508.10	125.31	0
GRID	408	0	417.36	505.20	133.28	0

GRID	409	0	418.35	502.30	141.25	0
GRID	410	0	419.35	499.40	149.22	0
GRID	411	0	420.34	496.50	157.19	0

\$ THIS GROUP OF GRIDS GENERATES OUTPUT IN COORD. SYSTEM 6
 \$ THE Z-AXIS FOR COORD. SYS. 5 IS NORMAL TO PLANE OF V-TAIL

GRID	431	0	410.39	525.50	77.50	6
GRID	432	0	411.39	522.60	85.47	6
GRID	433	0	412.38	519.70	93.44	6
GRID	434	0	413.38	516.80	101.41	6
GRID	435	0	414.37	513.90	109.38	6
GRID	436	0	415.37	511.00	117.34	6
GRID	437	0	416.36	508.10	125.31	6
GRID	438	0	417.36	505.20	133.28	6
GRID	439	0	418.35	502.30	141.25	6
GRID	440	0	419.35	499.40	149.22	6
GRID	441	0	420.34	496.50	157.19	6

\$ DUPLICATE GRIDS OF MAIN V-TAIL ARE DEPENDENT ON ELASTIC AXIS GRIDS

RBE2	581	401	123456	431
RBE2	582	402	123456	432
RBE2	583	403	123456	433
RBE2	584	404	123456	434
RBE2	585	405	123456	435
RBE2	586	406	123456	436
RBE2	587	407	123456	437
RBE2	588	408	123456	438
RBE2	589	409	123456	439
RBE2	590	410	123456	440
RBE2	591	411	123456	441

\$
 \$ RIGHT SIDE VERTICAL TAIL LEADING EDGE
 \$

GRID	1401	0	390.67	525.50	77.50	0
GRID	1402	0	392.36	522.60	85.47	0
GRID	1403	0	394.05	519.70	93.44	0
GRID	1404	0	395.73	516.80	101.41	0
GRID	1405	0	397.42	513.90	109.38	0
GRID	1406	0	399.11	511.00	117.34	0
GRID	1407	0	400.79	508.10	125.31	0
GRID	1408	0	402.48	505.20	133.28	0
GRID	1409	0	404.17	502.30	141.25	0
GRID	1410	0	405.85	499.40	149.22	0
GRID	1411	0	407.54	496.50	157.19	0

\$
 \$ LEADING EDGE V-TAIL GRIDS ARE DEPENDENT ON ELASTIC AXIS

RBE2	1271	401	123456	1401
RBE2	1272	402	123456	1402
RBE2	1273	403	123456	1403
RBE2	1274	404	123456	1404
RBE2	1275	405	123456	1405
RBE2	1276	406	123456	1406
RBE2	1277	407	123456	1407
RBE2	1278	408	123456	1408
RBE2	1279	409	123456	1409
RBE2	1280	410	123456	1410
RBE2	1281	411	123456	1411

\$
 \$ DUPLICATE GRIDS FOR VERTICAL TAIL LEADING EDGE
 \$ THE OUTPUT OF THESE GRIDS WILL BE IN COORD. SYST. 6

GRID	1431	0	390.67	525.50	77.50	6
GRID	1432	0	392.36	522.60	85.47	6
GRID	1433	0	394.05	519.70	93.44	6
GRID	1434	0	395.73	516.80	101.41	6
GRID	1435	0	397.42	513.90	109.38	6

GRID	1436	0	399.11	511.00	117.34	6
GRID	1437	0	400.79	508.10	125.31	6
GRID	1438	0	402.48	505.20	133.28	6
GRID	1439	0	404.17	502.30	141.25	6
GRID	1440	0	405.85	499.40	149.22	6
GRID	1441	0	407.54	496.50	157.19	6
\$ V-TAIL LEADING EDGE DUPLICATE GRIDS ARE DEPENDENT ON ELASTIC AXIS GRIDS						
RBE2	601	401	123456	1431		
RBE2	602	402	123456	1432		
RBE2	603	403	123456	1433		
RBE2	604	404	123456	1434		
RBE2	605	405	123456	1435		
RBE2	606	406	123456	1436		
RBE2	607	407	123456	1437		
RBE2	608	408	123456	1438		
RBE2	609	409	123456	1439		
RBE2	610	410	123456	1440		
RBE2	611	411	123456	1441		
\$						
\$ RIGHT SIDE VERTICAL TAIL TRAILING EDGE						
\$						
GRID	2401	0	439.97	525.50	77.50	0
GRID	2402	0	439.93	522.60	85.47	0
GRID	2403	0	439.89	519.70	93.44	0
GRID	2404	0	439.84	516.80	101.41	0
GRID	2405	0	439.80	513.90	109.38	0
GRID	2406	0	439.76	511.00	117.34	0
GRID	2407	0	439.71	508.10	125.31	0
GRID	2408	0	439.67	505.20	133.28	0
GRID	2409	0	439.63	502.30	141.25	0
GRID	2410	0	439.58	499.40	149.22	0
GRID	2411	0	439.54	496.50	157.19	0
\$ DUPLICATE GRIDS FOR VERTICAL TAIL TRAILING EDGE						
\$ THE OUTPUT FOR THESE GRIDS WILL BE IN COORD. SYST. 6						
GRID	2431	0	439.97	525.50	77.50	6
GRID	2432	0	439.93	522.60	85.47	6
GRID	2433	0	439.89	519.70	93.44	6
GRID	2434	0	439.84	516.80	101.41	6
GRID	2435	0	439.80	513.90	109.38	6
GRID	2436	0	439.76	511.00	117.34	6
GRID	2437	0	439.71	508.10	125.31	6
GRID	2438	0	439.67	505.20	133.28	6
GRID	2439	0	439.63	502.30	141.25	6
GRID	2440	0	439.58	499.40	149.22	6
GRID	2441	0	439.54	496.50	157.19	6
\$ DUPLICATE V-TAIL T.E. GRIDS ARE DEPENDENT ON ORIGINAL GRIDS						
RBE2	621	2401	123456	2431		
RBE2	622	2402	123456	2432		
RBE2	623	2403	123456	2433		
RBE2	624	2404	123456	2434		
RBE2	625	2405	123456	2435		
RBE2	626	2406	123456	2436		
RBE2	627	2407	123456	2437		
RBE2	628	2408	123456	2438		
RBE2	629	2409	123456	2439		
RBE2	630	2410	123456	2440		
RBE2	631	2411	123456	2441		
\$						
\$ GRIDS AT 80% CHORD HINGE-LINE OF RIGHT SIDE VERTICAL TAIL						
GRID	2601	0	430.110	525.500	77.500	0
GRID	2602	0	430.416	522.600	85.470	0
GRID	2603	0	430.722	519.700	93.440	0
GRID	2604	0	431.018	516.800	101.410	0

GRID	2605	0	431.324	513.900	109.380	0
GRID	2606	0	431.630	511.000	117.340	0
GRID	2607	0	431.926	508.100	125.310	0
GRID	2608	0	432.232	505.200	133.280	0
GRID	2609	0	432.538	502.300	141.250	0
GRID	2610	0	432.834	499.400	149.220	0
GRID	2611	0	433.140	496.500	157.190	0

\$
\$ *****

\$ END OF RIGHT SIDE VERTICAL TAIL DEFINITION

\$ *****

\$

\$ MAIN BEAMS FOR RIGHT WING

CBEAM	101	101	101	102	-1.	0.	0.
CBEAM	102	102	102	103	-1.	0.	0.
CBEAM	103	103	103	104	-1.	0.	0.
CBEAM	104	104	104	105	-1.	0.	0.
CBEAM	105	105	105	106	-1.	0.	0.
CBEAM	106	106	106	107	-1.	0.	0.
CBEAM	107	107	107	108	-1.	0.	0.
CBEAM	108	108	108	109	-1.	0.	0.
CBEAM	109	109	109	110	-1.	0.	0.
CBEAM	110	110	110	111	-1.	0.	0.
CBEAM	111	111	111	112	-1.	0.	0.
CBEAM	112	112	112	113	-1.	0.	0.
CBEAM	113	113	113	114	-1.	0.	0.
CBEAM	114	114	114	115	-1.	0.	0.
CBEAM	115	115	115	116	-1.	0.	0.
CBEAM	116	116	116	117	-1.	0.	0.
CBEAM	117	117	117	118	-1.	0.	0.
CBEAM	118	118	118	119	-1.	0.	0.
CBEAM	119	119	119	120	-1.	0.	0.
CBEAM	120	120	120	121	-1.	0.	0.
CBEAM	121	121	121	122	-1.	0.	0.
CBEAM	122	122	122	123	-1.	0.	0.
CBEAM	123	123	123	124	-1.	0.	0.
CBEAM	124	124	124	125	-1.	0.	0.
CBEAM	125	125	125	126	-1.	0.	0.
CBEAM	126	126	126	127	-1.	0.	0.
CBEAM	127	127	127	128	-1.	0.	0.
CBEAM	128	128	128	129	-1.	0.	0.
CBEAM	129	129	129	130	-1.	0.	0.
CBEAM	130	130	130	131	-1.	0.	0.
CBEAM	131	131	131	132	-1.	0.	0.
CBEAM	132	132	132	133	-1.	0.	0.
CBEAM	133	133	133	134	-1.	0.	0.
CBEAM	134	134	134	135	-1.	0.	0.
CBEAM	135	135	135	136	-1.	0.	0.
CBEAM	136	136	136	137	-1.	0.	0.
CBEAM	137	137	137	138	-1.	0.	0.
CBEAM	138	138	138	139	-1.	0.	0.
CBEAM	139	139	139	140	-1.	0.	0.
CBEAM	140	140	140	141	-1.	0.	0.

\$ BEAMS FOR RIGHT WING TIP BOOM

CBEAM	201	201	201	202	0.	1.	0.
CBEAM	202	202	202	203	0.	1.	0.
CBEAM	203	203	203	204	0.	1.	0.
CBEAM	204	204	204	205	0.	1.	0.
CBEAM	205	205	205	206	0.	1.	0.
CBEAM	206	206	206	207	0.	1.	0.
CBEAM	207	207	207	208	0.	1.	0.
CBEAM	208	208	208	209	0.	1.	0.
CBEAM	209	209	209	210	0.	1.	0.

CBEAM	210	210	210	211	0.	1.	0.
CBEAM	211	211	211	212	0.	1.	0.
CBEAM	212	212	212	213	0.	1.	0.
CBEAM	213	213	213	214	0.	1.	0.
CBEAM	214	214	214	215	0.	1.	0.
CBEAM	215	215	215	216	0.	1.	0.
CBEAM	216	216	216	217	0.	1.	0.
CBEAM	217	217	217	218	0.	1.	0.
CBEAM	218	218	218	219	0.	1.	0.
CBEAM	219	219	219	220	0.	1.	0.
CBEAM	220	220	220	221	0.	1.	0.
CBEAM	221	221	221	222	0.	1.	0.
CBEAM	222	222	222	223	0.	1.	0.
CBEAM	223	223	223	224	0.	1.	0.
CBEAM	224	224	224	225	0.	1.	0.
CBEAM	225	225	225	226	0.	1.	0.
CBEAM	226	226	226	227	0.	1.	0.
CBEAM	227	227	227	228	0.	1.	0.
CBEAM	228	228	228	229	0.	1.	0.
CBEAM	229	229	229	230	0.	1.	0.
CBEAM	230	230	230	231	0.	1.	0.
CBEAM	231	231	231	232	0.	1.	0.
CBEAM	232	232	232	233	0.	1.	0.
CBEAM	233	233	233	234	0.	1.	0.
CBEAM	234	234	234	235	0.	1.	0.
CBEAM	235	235	235	236	0.	1.	0.
CBEAM	236	236	236	237	0.	1.	0.
CBEAM	237	237	237	238	0.	1.	0.
CBEAM	238	238	238	239	0.	1.	0.
CBEAM	239	239	239	240	0.	1.	0.
CBEAM	240	240	240	241	0.	1.	0.
CBEAM	241	241	241	242	0.	1.	0.
CBEAM	242	242	242	243	0.	1.	0.
\$ RIGHT SIDE HORIZONTAL TAIL BEAMS							
CBEAM	301	301	301	302	-1.	0.	0.
CBEAM	302	302	302	303	-1.	0.	0.
CBEAM	303	303	303	304	-1.	0.	0.
CBEAM	304	304	304	305	-1.	0.	0.
CBEAM	305	305	305	306	-1.	0.	0.
CBEAM	306	306	306	307	-1.	0.	0.
CBEAM	307	307	307	308	-1.	0.	0.
CBEAM	308	308	308	309	-1.	0.	0.
CBEAM	309	309	309	310	-1.	0.	0.
CBEAM	310	310	310	311	-1.	0.	0.
\$ RIGHT SIDE VERTICAL TAIL BEAMS							
CBEAM	401	401	401	402	1.	0.	0.
CBEAM	402	402	402	403	1.	0.	0.
CBEAM	403	403	403	404	1.	0.	0.
CBEAM	404	404	404	405	1.	0.	0.
CBEAM	405	405	405	406	1.	0.	0.
CBEAM	406	406	406	407	1.	0.	0.
CBEAM	407	407	407	408	1.	0.	0.
CBEAM	408	408	408	409	1.	0.	0.
CBEAM	409	409	409	410	1.	0.	0.
CBEAM	410	410	410	411	1.	0.	0.
\$							
\$							
\$ RIGHT SIDE BEAMS FROM H-TAIL MAIN BEAM TO HINGE LINE							
CBEAM	2301	2301	301	2501	302		
CBEAM	2302	2301	302	2502	301		
CBEAM	2303	2301	303	2503	301		
CBEAM	2304	2301	304	2504	301		
CBEAM	2305	2301	305	2505	301		

CBEAM	2306	2301	306	2506	301
CBEAM	2307	2301	307	2507	301
CBEAM	2308	2301	308	2508	301
CBEAM	2309	2301	309	2509	301
CBEAM	2310	2301	310	2510	301
CBEAM	2311	2301	311	2511	301

\$

\$ RIGHT SIDE BEAMS FROM H-TAIL HINGE LINE TO H-TAIL TRAILING EDGE

CBEAM	2321	2301	2501	2301	2502
CBEAM	2322	2301	2502	2302	2501
CBEAM	2323	2301	2503	2303	2501
CBEAM	2324	2301	2504	2304	2501
CBEAM	2325	2301	2505	2305	2501
CBEAM	2326	2301	2506	2306	2501
CBEAM	2327	2301	2507	2307	2501
CBEAM	2328	2301	2508	2308	2501
CBEAM	2329	2301	2509	2309	2501
CBEAM	2330	2301	2510	2310	2501
CBEAM	2331	2301	2511	2311	2501

\$ RIGHT SIDE BEAMS FROM V-TAIL MAIN BEAM TO HINGE LINE

CBEAM	2401	2401	401	2601	402
CBEAM	2402	2401	402	2602	401
CBEAM	2403	2401	403	2603	401
CBEAM	2404	2401	404	2604	401
CBEAM	2405	2401	405	2605	401
CBEAM	2406	2401	406	2606	401
CBEAM	2407	2401	407	2607	401
CBEAM	2408	2401	408	2608	401
CBEAM	2409	2401	409	2609	401
CBEAM	2410	2401	410	2610	401
CBEAM	2411	2401	411	2611	401

\$

\$ RIGHT SIDE BEAMS FROM V-TAIL HINGE LINE TO V-TAIL TRAILING EDGE

CBEAM	2421	2401	2601	2401	2602
CBEAM	2422	2401	2602	2402	2601
CBEAM	2423	2401	2603	2403	2601
CBEAM	2424	2401	2604	2404	2601
CBEAM	2425	2401	2605	2405	2601
CBEAM	2426	2401	2606	2406	2601
CBEAM	2427	2401	2607	2407	2601
CBEAM	2428	2401	2608	2408	2601
CBEAM	2429	2401	2609	2409	2601
CBEAM	2430	2401	2610	2410	2601
CBEAM	2431	2401	2611	2411	2601

\$

\$ CONNECTIONS OF WING TO BOOM, H-TAIL, V-TAIL ON LEFT SIDE

RBE2	3102	3039	123456	3055
RBE2	3103	3077	123456	3083
RBE2	3104	3079	123456	3094

\$

\$ NODES ON LEFT WING ELASTIC AXIS

GRID	3000	0	156.480	-13.150	49.670	0
GRID	3001	0	156.450	-26.290	50.370	0
GRID	3002	0	156.410	-39.440	51.060	0
GRID	3003	0	156.380	-52.590	51.750	0
GRID	3004	0	156.340	-65.740	52.450	0
GRID	3005	0	156.310	-78.880	53.140	0
GRID	3006	0	156.280	-92.030	53.830	0
GRID	3007	0	156.240	-105.180	54.530	0
GRID	3008	0	156.210	-118.320	55.220	0
GRID	3009	0	156.180	-131.470	55.910	0
GRID	3010	0	156.140	-144.620	56.610	0
GRID	3011	0	156.110	-157.760	57.300	0

GRID	3012	0	156.080-170.910	57.990	0
GRID	3013	0	156.040-184.060	58.690	0
GRID	3014	0	156.010-197.210	59.380	0
GRID	3015	0	155.980-210.350	60.070	0
GRID	3016	0	155.940-223.500	60.770	0
GRID	3017	0	155.880-236.630	61.460	0
GRID	3018	0	155.820-249.760	62.160	0
GRID	3019	0	155.760-262.890	62.860	0
GRID	3020	0	155.700-276.020	63.550	0
GRID	3021	0	155.640-289.150	64.250	0
GRID	3022	0	155.580-302.280	64.950	0
GRID	3023	0	155.520-315.410	65.640	0
GRID	3024	0	155.460-328.540	66.340	0
GRID	3025	0	155.390-341.670	67.040	0
GRID	3026	0	155.330-354.800	67.730	0
GRID	3027	0	155.270-367.930	68.430	0
GRID	3028	0	155.210-381.070	69.130	0
GRID	3029	0	155.150-394.200	69.820	0
GRID	3030	0	155.090-407.330	70.520	0
GRID	3031	0	155.030-420.460	71.220	0
GRID	3032	0	154.970-433.590	71.910	0
GRID	3033	0	154.910-446.720	72.610	0
GRID	3034	0	154.850-459.850	73.310	0
GRID	3035	0	154.790-472.980	74.000	0
GRID	3036	0	154.720-486.110	74.700	0
GRID	3037	0	154.660-499.240	75.400	0
GRID	3038	0	154.600-512.370	76.090	0
GRID	3039	0	154.540-525.500	76.790	0
\$ NODES ON LEFT WING LEADING EDGE CHORD					
GRID	3105	0	132.920 -13.150	49.670	0
GRID	3106	0	133.010 -26.290	50.370	0
GRID	3107	0	133.100 -39.440	51.060	0
GRID	3108	0	133.180 -52.590	51.750	0
GRID	3109	0	133.270 -65.740	52.450	0
GRID	3110	0	133.360 -78.880	53.140	0
GRID	3111	0	133.450 -92.030	53.830	0
GRID	3112	0	133.540-105.180	54.530	0
GRID	3113	0	133.630-118.320	55.220	0
GRID	3114	0	133.710-131.470	55.910	0
GRID	3115	0	133.800-144.620	56.610	0
GRID	3116	0	133.890-157.760	57.300	0
GRID	3117	0	133.980-170.910	57.990	0
GRID	3118	0	134.070-184.060	58.690	0
GRID	3119	0	134.160-197.210	59.380	0
GRID	3120	0	134.240-210.350	60.070	0
GRID	3121	0	134.330-223.500	60.770	0
GRID	3122	0	134.490-236.630	61.460	0
GRID	3123	0	134.650-249.760	62.160	0
GRID	3124	0	134.810-262.890	62.860	0
GRID	3125	0	134.970-276.020	63.550	0
GRID	3126	0	135.140-289.150	64.250	0
GRID	3127	0	135.300-302.280	64.950	0
GRID	3128	0	135.460-315.410	65.640	0
GRID	3129	0	135.620-328.540	66.340	0
GRID	3130	0	135.780-341.670	67.040	0
GRID	3131	0	135.940-354.800	67.730	0
GRID	3132	0	136.100-367.930	68.430	0
GRID	3133	0	136.260-381.070	69.130	0
GRID	3134	0	136.420-394.200	69.820	0
GRID	3135	0	136.580-407.330	70.520	0
GRID	3136	0	136.740-420.460	71.220	0
GRID	3137	0	136.900-433.590	71.910	0
GRID	3138	0	137.060-446.720	72.610	0

GRID	3139	0	137.220-459.850	73.310	0
GRID	3140	0	137.380-472.980	74.000	0
GRID	3141	0	137.550-486.110	74.700	0
GRID	3142	0	137.710-499.240	75.400	0
GRID	3143	0	137.870-512.370	76.090	0
GRID	3144	0	138.030-525.500	76.790	0
\$ NODES ON LEFT WING TRAILING EDGE CHORD					
GRID	3167	0	191.820 -13.150	49.670	0
GRID	3168	0	191.600 -26.290	50.370	0
GRID	3169	0	191.390 -39.440	51.060	0
GRID	3170	0	191.170 -52.590	51.750	0
GRID	3171	0	190.950 -65.740	52.450	0
GRID	3172	0	190.740 -78.880	53.140	0
GRID	3173	0	190.520 -92.030	53.830	0
GRID	3174	0	190.300-105.180	54.530	0
GRID	3175	0	190.090-118.320	55.220	0
GRID	3176	0	189.870-131.470	55.910	0
GRID	3177	0	189.660-144.620	56.610	0
GRID	3178	0	189.440-157.760	57.300	0
GRID	3179	0	189.220-170.910	57.990	0
GRID	3180	0	189.010-184.060	58.690	0
GRID	3181	0	188.790-197.210	59.380	0
GRID	3182	0	188.580-210.350	60.070	0
GRID	3183	0	188.360-223.500	60.770	0
GRID	3184	0	187.970-236.630	61.460	0
GRID	3185	0	187.570-249.760	62.160	0
GRID	3186	0	187.180-262.890	62.860	0
GRID	3187	0	186.790-276.020	63.550	0
GRID	3188	0	186.390-289.150	64.250	0
GRID	3189	0	186.000-302.280	64.950	0
GRID	3190	0	185.610-315.410	65.640	0
GRID	3191	0	185.210-328.540	66.340	0
GRID	3192	0	184.820-341.670	67.040	0
GRID	3193	0	184.430-354.800	67.730	0
GRID	3194	0	184.030-367.930	68.430	0
GRID	3195	0	183.640-381.070	69.130	0
GRID	3196	0	183.250-394.200	69.820	0
GRID	3197	0	182.850-407.330	70.520	0
GRID	3198	0	182.460-420.460	71.220	0
GRID	3199	0	182.070-433.590	71.910	0
GRID	3200	0	181.670-446.720	72.610	0
GRID	3201	0	181.280-459.850	73.310	0
GRID	3202	0	180.890-472.980	74.000	0
GRID	3203	0	180.490-486.110	74.700	0
GRID	3204	0	180.100-499.240	75.400	0
GRID	3205	0	179.710-512.370	76.090	0
GRID	3206	0	179.310-525.500	76.790	0
\$ NODES ON LEFT WING BOOM					
GRID	3040	0	25.000-525.500	77.500	0
GRID	3041	0	33.611-525.500	77.500	0
GRID	3042	0	42.222-525.500	77.500	0
GRID	3043	0	50.833-525.500	77.500	0
GRID	3044	0	59.444-525.500	77.500	0
GRID	3045	0	68.056-525.500	77.500	0
GRID	3046	0	76.667-525.500	77.500	0
GRID	3047	0	85.278-525.500	77.500	0
GRID	3048	0	93.889-525.500	77.500	0
GRID	3049	0	102.500-525.500	77.500	0
GRID	3050	0	111.111-525.500	77.500	0
GRID	3051	0	119.722-525.500	77.500	0
GRID	3052	0	128.333-525.500	77.500	0
GRID	3053	0	136.944-525.500	77.500	0
GRID	3054	0	145.556-525.500	77.500	0

GRID	3055	0	154.167-525.500	77.500	0
GRID	3056	0	162.778-525.500	77.500	0
GRID	3057	0	171.389-525.500	77.500	0
GRID	3058	0	180.000-525.500	77.500	0
GRID	3059	0	190.000-525.500	77.500	0
GRID	3060	0	200.000-525.500	77.500	0
GRID	3061	0	210.000-525.500	77.500	0
GRID	3062	0	220.000-525.500	77.500	0
GRID	3063	0	230.000-525.500	77.500	0
GRID	3064	0	240.000-525.500	77.500	0
GRID	3065	0	250.000-525.500	77.500	0
GRID	3066	0	260.000-525.500	77.500	0
GRID	3067	0	270.000-525.500	77.500	0
GRID	3068	0	280.000-525.500	77.500	0
GRID	3069	0	290.000-525.500	77.500	0
GRID	3070	0	300.000-525.500	77.500	0
GRID	3071	0	310.000-525.500	77.500	0
GRID	3072	0	320.000-525.500	77.500	0
GRID	3073	0	330.000-525.500	77.500	0
GRID	3074	0	340.000-525.500	77.500	0
GRID	3075	0	350.000-525.500	77.500	0
GRID	3076	0	360.000-525.500	77.500	0
GRID	3077	0	370.000-525.500	77.500	0
GRID	3078	0	380.000-525.500	77.500	0
GRID	3079	0	390.000-525.500	77.500	0
GRID	3080	0	400.000-525.500	77.500	0
GRID	3081	0	410.000-525.500	77.500	0
GRID	3082	0	420.000-525.500	77.500	0
\$ NODES ON LEFT-SIDE H-TAIL ELASTIC AXIS					
GRID	3083	0	379.750-525.500	77.360	0
GRID	3084	0	379.610-535.000	79.010	0
GRID	3085	0	379.470-544.500	80.670	0
GRID	3086	0	379.340-554.000	82.330	0
GRID	3087	0	379.200-563.500	83.980	0
GRID	3088	0	379.060-573.000	85.640	0
GRID	3089	0	378.920-582.500	87.300	0
GRID	3090	0	378.790-592.000	88.950	0
GRID	3091	0	378.650-601.500	90.610	0
GRID	3092	0	378.510-611.000	92.270	0
GRID	3093	0	378.370-620.500	93.920	0
\$ NODES ON LEFT-SIDE H-TAIL LEADING EDGE					
GRID	3145	0	355.080-525.500	77.360	0
GRID	3146	0	356.170-535.000	79.010	0
GRID	3147	0	357.270-544.500	80.670	0
GRID	3148	0	358.360-554.000	82.330	0
GRID	3149	0	359.460-563.500	83.980	0
GRID	3150	0	360.560-573.000	85.640	0
GRID	3151	0	361.650-582.500	87.300	0
GRID	3152	0	362.750-592.000	88.950	0
GRID	3153	0	363.850-601.500	90.610	0
GRID	3154	0	364.940-611.000	92.270	0
GRID	3155	0	366.040-620.500	93.920	0
\$ NODES ON LEFT-SIDE H-TAIL TRAILING EDGE					
GRID	3207	0	416.830-525.500	77.360	0
GRID	3208	0	414.840-535.000	79.010	0
GRID	3209	0	412.850-544.500	80.670	0
GRID	3210	0	410.860-554.000	82.330	0
GRID	3211	0	408.870-563.500	83.980	0
GRID	3212	0	406.880-573.000	85.640	0
GRID	3213	0	404.880-582.500	87.300	0
GRID	3214	0	402.890-592.000	88.950	0
GRID	3215	0	400.900-601.500	90.610	0
GRID	3216	0	398.910-611.000	92.270	0

GRID	3217	0 396.920-620.500	93.920	0
\$				
\$ GRIDS AT 80% CHORD HINGE-LINE OF LEFT SIDE HORIZONTAL TAIL				
GRID	3401	0 404.480-525.500	77.360	0
GRID	3402	0 403.106-535.000	79.010	0
GRID	3403	0 401.734-544.500	80.670	0
GRID	3404	0 400.360-554.000	82.330	0
GRID	3405	0 398.988-563.500	83.980	0
GRID	3406	0 397.616-573.000	85.640	0
GRID	3407	0 396.234-582.500	87.300	0
GRID	3408	0 394.862-592.000	88.950	0
GRID	3409	0 393.490-601.500	90.610	0
GRID	3410	0 392.116-611.000	92.270	0
GRID	3411	0 390.744-620.500	93.920	0
\$				
\$ NODES ON LEFT-SIDE VERTICAL TAIL ELASTIC AXIS				
GRID	3094	0 410.390-525.500	77.500	0
GRID	3095	0 411.390-522.600	85.470	0
GRID	3096	0 412.380-519.700	93.440	0
GRID	3097	0 413.380-516.800	101.410	0
GRID	3098	0 414.370-513.900	109.380	0
GRID	3099	0 415.370-511.000	117.340	0
GRID	3100	0 416.360-508.100	125.310	0
GRID	3101	0 417.360-505.200	133.280	0
GRID	3102	0 418.350-502.300	141.250	0
GRID	3103	0 419.350-499.400	149.220	0
GRID	3104	0 420.340-496.500	157.190	0
\$ NODES ON LEFT-SIDE VERTICAL TAIL LEADING EDGE				
GRID	3156	0 390.670-525.500	77.500	0
GRID	3157	0 392.360-522.600	85.470	0
GRID	3158	0 394.050-519.700	93.440	0
GRID	3159	0 395.730-516.800	101.410	0
GRID	3160	0 397.420-513.900	109.380	0
GRID	3161	0 399.110-511.000	117.340	0
GRID	3162	0 400.790-508.100	125.310	0
GRID	3163	0 402.480-505.200	133.280	0
GRID	3164	0 404.170-502.300	141.250	0
GRID	3165	0 405.850-499.400	149.220	0
GRID	3166	0 407.540-496.500	157.190	0
\$ NODES ON LEFT-SIDE VERTICAL TAIL TRAILING EDGE				
GRID	3218	0 439.970-525.500	77.500	0
GRID	3219	0 439.930-522.600	85.470	0
GRID	3220	0 439.890-519.700	93.440	0
GRID	3221	0 439.840-516.800	101.410	0
GRID	3222	0 439.800-513.900	109.380	0
GRID	3223	0 439.760-511.000	117.340	0
GRID	3224	0 439.710-508.100	125.310	0
GRID	3225	0 439.670-505.200	133.280	0
GRID	3226	0 439.630-502.300	141.250	0
GRID	3227	0 439.580-499.400	149.220	0
GRID	3228	0 439.540-496.500	157.190	0
\$				
\$				
\$ GRIDS AT 80% CHORD HINGE-LINE OF LEFT SIDE VERTICAL TAIL				
GRID	3501	0 430.110-525.500	77.500	0
GRID	3502	0 430.416-522.600	85.470	0
GRID	3503	0 430.722-519.700	93.440	0
GRID	3504	0 431.018-516.800	101.410	0
GRID	3505	0 431.324-513.900	109.380	0
GRID	3506	0 431.630-511.000	117.340	0
GRID	3507	0 431.926-508.100	125.310	0
GRID	3508	0 432.232-505.200	133.280	0
GRID	3509	0 432.538-502.300	141.250	0

GRID	3510	0	432.834-499.400	149.220	0		
GRID	3511	0	433.140-496.500	157.190	0		
\$							
\$ LEFT-SIDE WING ELASTIC AXIS BEAMS							
CBEAM	3000	101	3000	101	-1.0	0.0	0.0
CBEAM	3001	102	3001	3000	-1.0	0.0	0.0
CBEAM	3002	103	3002	3001	-1.0	0.0	0.0
CBEAM	3003	104	3003	3002	-1.0	0.0	0.0
CBEAM	3004	105	3004	3003	-1.0	0.0	0.0
CBEAM	3005	106	3005	3004	-1.0	0.0	0.0
CBEAM	3006	107	3006	3005	-1.0	0.0	0.0
CBEAM	3007	108	3007	3006	-1.0	0.0	0.0
CBEAM	3008	109	3008	3007	-1.0	0.0	0.0
CBEAM	3009	110	3009	3008	-1.0	0.0	0.0
CBEAM	3010	111	3010	3009	-1.0	0.0	0.0
CBEAM	3011	112	3011	3010	-1.0	0.0	0.0
CBEAM	3012	113	3012	3011	-1.0	0.0	0.0
CBEAM	3013	114	3013	3012	-1.0	0.0	0.0
CBEAM	3014	115	3014	3013	-1.0	0.0	0.0
CBEAM	3015	116	3015	3014	-1.0	0.0	0.0
CBEAM	3016	117	3016	3015	-1.0	0.0	0.0
CBEAM	3017	118	3017	3016	-1.0	0.0	0.0
CBEAM	3018	119	3018	3017	-1.0	0.0	0.0
CBEAM	3019	120	3019	3018	-1.0	0.0	0.0
CBEAM	3020	121	3020	3019	-1.0	0.0	0.0
CBEAM	3021	122	3021	3020	-1.0	0.0	0.0
CBEAM	3022	123	3022	3021	-1.0	0.0	0.0
CBEAM	3023	124	3023	3022	-1.0	0.0	0.0
CBEAM	3024	125	3024	3023	-1.0	0.0	0.0
CBEAM	3025	126	3025	3024	-1.0	0.0	0.0
CBEAM	3026	127	3026	3025	-1.0	0.0	0.0
CBEAM	3027	128	3027	3026	-1.0	0.0	0.0
CBEAM	3028	129	3028	3027	-1.0	0.0	0.0
CBEAM	3029	130	3029	3028	-1.0	0.0	0.0
CBEAM	3030	131	3030	3029	-1.0	0.0	0.0
CBEAM	3031	132	3031	3030	-1.0	0.0	0.0
CBEAM	3032	133	3032	3031	-1.0	0.0	0.0
CBEAM	3033	134	3033	3032	-1.0	0.0	0.0
CBEAM	3034	135	3034	3033	-1.0	0.0	0.0
CBEAM	3035	136	3035	3034	-1.0	0.0	0.0
CBEAM	3036	137	3036	3035	-1.0	0.0	0.0
CBEAM	3037	138	3037	3036	-1.0	0.0	0.0
CBEAM	3038	139	3038	3037	-1.0	0.0	0.0
CBEAM	3039	140	3039	3038	-1.0	0.0	0.0
\$							
\$ LEFT-SIDE BEAMS FOR BOOM AT WING-TIP							
CBEAM	3040	201	3041	3040	0.0	-1.0	0.0
CBEAM	3041	202	3042	3041	0.0	-1.0	0.0
CBEAM	3042	203	3043	3042	0.0	-1.0	0.0
CBEAM	3043	204	3044	3043	0.0	-1.0	0.0
CBEAM	3044	205	3045	3044	0.0	-1.0	0.0
CBEAM	3045	206	3046	3045	0.0	-1.0	0.0
CBEAM	3046	207	3047	3046	0.0	-1.0	0.0
CBEAM	3047	208	3048	3047	0.0	-1.0	0.0
CBEAM	3048	209	3049	3048	0.0	-1.0	0.0
CBEAM	3049	210	3050	3049	0.0	-1.0	0.0
CBEAM	3050	211	3051	3050	0.0	-1.0	0.0
CBEAM	3051	212	3052	3051	0.0	-1.0	0.0
CBEAM	3052	213	3053	3052	0.0	-1.0	0.0
CBEAM	3053	214	3054	3053	0.0	-1.0	0.0
CBEAM	3054	215	3055	3054	0.0	-1.0	0.0
CBEAM	3055	216	3056	3055	0.0	-1.0	0.0
CBEAM	3056	217	3057	3056	0.0	-1.0	0.0

CBEAM	3057	218	3058	3057	0.0	-1.0	0.0
CBEAM	3058	219	3059	3058	0.0	-1.0	0.0
CBEAM	3059	220	3060	3059	0.0	-1.0	0.0
CBEAM	3060	221	3061	3060	0.0	-1.0	0.0
CBEAM	3061	222	3062	3061	0.0	-1.0	0.0
CBEAM	3062	223	3063	3062	0.0	-1.0	0.0
CBEAM	3063	224	3064	3063	0.0	-1.0	0.0
CBEAM	3064	225	3065	3064	0.0	-1.0	0.0
CBEAM	3065	226	3066	3065	0.0	-1.0	0.0
CBEAM	3066	227	3067	3066	0.0	-1.0	0.0
CBEAM	3067	228	3068	3067	0.0	-1.0	0.0
CBEAM	3068	229	3069	3068	0.0	-1.0	0.0
CBEAM	3069	230	3070	3069	0.0	-1.0	0.0
CBEAM	3070	231	3071	3070	0.0	-1.0	0.0
CBEAM	3071	232	3072	3071	0.0	-1.0	0.0
CBEAM	3072	233	3073	3072	0.0	-1.0	0.0
CBEAM	3073	234	3074	3073	0.0	-1.0	0.0
CBEAM	3074	235	3075	3074	0.0	-1.0	0.0
CBEAM	3075	236	3076	3075	0.0	-1.0	0.0
CBEAM	3076	237	3077	3076	0.0	-1.0	0.0
CBEAM	3077	238	3078	3077	0.0	-1.0	0.0
CBEAM	3078	239	3079	3078	0.0	-1.0	0.0
CBEAM	3079	240	3080	3079	0.0	-1.0	0.0
CBEAM	3080	241	3081	3080	0.0	-1.0	0.0
CBEAM	3081	242	3082	3081	0.0	-1.0	0.0

\$

\$ LEFT-SIDE BEAMS FOR ELASTIC AXIS OF HORIZONTAL TAIL

CBEAM	3082	301	3084	3083	-1.0	0.0	0.0
CBEAM	3083	302	3085	3084	-1.0	0.0	0.0
CBEAM	3084	303	3086	3085	-1.0	0.0	0.0
CBEAM	3085	304	3087	3086	-1.0	0.0	0.0
CBEAM	3086	305	3088	3087	-1.0	0.0	0.0
CBEAM	3087	306	3089	3088	-1.0	0.0	0.0
CBEAM	3088	307	3090	3089	-1.0	0.0	0.0
CBEAM	3089	308	3091	3090	-1.0	0.0	0.0
CBEAM	3090	309	3092	3091	-1.0	0.0	0.0
CBEAM	3091	310	3093	3092	-1.0	0.0	0.0

\$

\$ LEFT-SIDE BEAMS ON H-TAIL FROM ELASTIC AXIS TO HINGE LINE.

CBEAM	3309	2301	3083	3401	3084
CBEAM	3310	2301	3084	3402	3083
CBEAM	3311	2301	3085	3403	3083
CBEAM	3312	2301	3086	3404	3083
CBEAM	3313	2301	3087	3405	3083
CBEAM	3314	2301	3088	3406	3083
CBEAM	3315	2301	3089	3407	3083
CBEAM	3316	2301	3090	3408	3083
CBEAM	3317	2301	3091	3409	3083
CBEAM	3318	2301	3092	3410	3083
CBEAM	3319	2301	3093	3411	3083

\$ LEFT-SIDE BEAMS ON H-TAIL FROM HINGE LINE TO T.E.

CBEAM	3401	2301	3401	3207	3402
CBEAM	3402	2301	3402	3208	3401
CBEAM	3403	2301	3403	3209	3401
CBEAM	3404	2301	3404	3210	3401
CBEAM	3405	2301	3405	3211	3401
CBEAM	3406	2301	3406	3212	3401
CBEAM	3407	2301	3407	3213	3401
CBEAM	3408	2301	3408	3214	3401
CBEAM	3409	2301	3409	3215	3401
CBEAM	3410	2301	3410	3216	3401
CBEAM	3411	2301	3411	3217	3401

\$ LEFT-SIDE BEAMS FOR ELASTIC AXIS OF VERTICAL TAIL

CBEAM	3092	401	3095	3094	1.0	0.0	0.0
CBEAM	3093	402	3096	3095	1.0	0.0	0.0
CBEAM	3094	403	3097	3096	1.0	0.0	0.0
CBEAM	3095	404	3098	3097	1.0	0.0	0.0
CBEAM	3096	405	3099	3098	1.0	0.0	0.0
CBEAM	3097	406	3100	3099	1.0	0.0	0.0
CBEAM	3098	407	3101	3100	1.0	0.0	0.0
CBEAM	3099	408	3102	3101	1.0	0.0	0.0
CBEAM	3100	409	3103	3102	1.0	0.0	0.0
CBEAM	3101	410	3104	3103	1.0	0.0	0.0

\$

\$ LEFT-SIDE BEAMS ON V-TAIL FROM E.A. TO HINGE LINE

CBEAM	3320	2401	3094	3501	3095
CBEAM	3321	2401	3095	3502	3094
CBEAM	3322	2401	3096	3503	3094
CBEAM	3323	2401	3097	3504	3094
CBEAM	3324	2401	3098	3505	3094
CBEAM	3325	2401	3099	3506	3094
CBEAM	3326	2401	3100	3507	3094
CBEAM	3327	2401	3101	3508	3094
CBEAM	3328	2401	3102	3509	3094
CBEAM	3329	2401	3103	3510	3094
CBEAM	3330	2401	3104	3511	3094

\$ LEFT-SIDE BEAMS ON V-TAIL FROM HINGE LINE TO T.E.

CBEAM	3420	2401	3501	3218	3502
CBEAM	3421	2401	3502	3219	3501
CBEAM	3422	2401	3503	3220	3501
CBEAM	3423	2401	3504	3221	3501
CBEAM	3424	2401	3505	3222	3501
CBEAM	3425	2401	3506	3223	3501
CBEAM	3426	2401	3507	3224	3501
CBEAM	3427	2401	3508	3225	3501
CBEAM	3428	2401	3509	3226	3501
CBEAM	3429	2401	3510	3227	3501
CBEAM	3430	2401	3511	3228	3501

\$

\$ LEFT-SIDE WING LEADING AND TRAILING EDGE GRIDS ARE DEPENDENT ON E.A.GRIDS

RBE2	3207	3000	123456	3105	3167
RBE2	3208	3001	123456	3106	3168
RBE2	3209	3002	123456	3107	3169
RBE2	3210	3003	123456	3108	3170
RBE2	3211	3004	123456	3109	3171
RBE2	3212	3005	123456	3110	3172
RBE2	3213	3006	123456	3111	3173
RBE2	3214	3007	123456	3112	3174
RBE2	3215	3008	123456	3113	3175
RBE2	3216	3009	123456	3114	3176
RBE2	3217	3010	123456	3115	3177
RBE2	3218	3011	123456	3116	3178
RBE2	3219	3012	123456	3117	3179
RBE2	3220	3013	123456	3118	3180
RBE2	3221	3014	123456	3119	3181
RBE2	3222	3015	123456	3120	3182
RBE2	3223	3016	123456	3121	3183
RBE2	3224	3017	123456	3122	3184
RBE2	3225	3018	123456	3123	3185
RBE2	3226	3019	123456	3124	3186
RBE2	3227	3020	123456	3125	3187
RBE2	3228	3021	123456	3126	3188
RBE2	3229	3022	123456	3127	3189
RBE2	3230	3023	123456	3128	3190
RBE2	3231	3024	123456	3129	3191
RBE2	3232	3025	123456	3130	3192

RBE2	3233	3026	123456	3131	3193
RBE2	3234	3027	123456	3132	3194
RBE2	3235	3028	123456	3133	3195
RBE2	3236	3029	123456	3134	3196
RBE2	3237	3030	123456	3135	3197
RBE2	3238	3031	123456	3136	3198
RBE2	3239	3032	123456	3137	3199
RBE2	3240	3033	123456	3138	3200
RBE2	3241	3034	123456	3139	3201
RBE2	3242	3035	123456	3140	3202
RBE2	3243	3036	123456	3141	3203
RBE2	3244	3037	123456	3142	3204
RBE2	3245	3038	123456	3143	3205
RBE2	3246	3039	123456	3144	3206
\$ LEFT-SIDE HORIZONTAL TAIL L.E.IS DEPENDENT ON ELASTIC AXIS					
RBE2	3247	3083	123456	3145	
RBE2	3248	3084	123456	3146	
RBE2	3249	3085	123456	3147	
RBE2	3250	3086	123456	3148	
RBE2	3251	3087	123456	3149	
RBE2	3252	3088	123456	3150	
RBE2	3253	3089	123456	3151	
RBE2	3254	3090	123456	3152	
RBE2	3255	3091	123456	3153	
RBE2	3256	3092	123456	3154	
RBE2	3257	3093	123456	3155	
\$ LEFT-SIDE VERTICAL TAIL L.E.IS DEPENDENT ON ELASTIC AXIS					
RBE2	3258	3094	123456	3156	
RBE2	3259	3095	123456	3157	
RBE2	3260	3096	123456	3158	
RBE2	3261	3097	123456	3159	
RBE2	3262	3098	123456	3160	
RBE2	3263	3099	123456	3161	
RBE2	3264	3100	123456	3162	
RBE2	3265	3101	123456	3163	
RBE2	3266	3102	123456	3164	
RBE2	3267	3103	123456	3165	
RBE2	3268	3104	123456	3166	
\$					

• **Program full_mass.dat**

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$      Centerline mass
CONM2      601      100      -1 892.200 125.800 0.00000 86.1000      +
+      528.0E+3 0.000001780.E+3 0.00000 0.000001390.E+3
$      Right wing masses
CONM2      602      102      -1 7.91000 157.540 6.57000 49.1600      +
+      114.000 0.00000 2357.10 0.00000 0.00000 2471.10
CONM2      603      103      -1 7.75000 157.670 19.7200 49.8300      +
+      111.700 0.00000 2285.60 0.00000 0.00000 2397.20
CONM2      604      104      -1 7.60000 157.800 32.8700 50.5000      +
+      109.400 0.00000 2216.70 0.00000 0.00000 2326.10
CONM2      605      105      -1 7.45000 157.920 46.0100 51.1700      +
+      107.300 0.00000 2150.30 0.00000 0.00000 2257.60
CONM2      606      106      -1 7.30000 158.050 59.1600 51.8400      +
+      105.200 0.00000 2086.50 0.00000 0.00000 2191.60
CONM2      607      107      -1 7.16000 158.170 72.3100 52.5100      +
+      103.200 0.00000 2025.00 0.00000 0.00000 2128.20
CONM2      608      108      -1 7.03000 158.300 85.4600 53.1700      +
+      101.200 0.00000 1966.00 0.00000 0.00000 2067.20
CONM2      609      109      -1 6.90000 158.420 98.6000 53.8400      +
+      99.4000 0.00000 1909.20 0.00000 0.00000 2008.60

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CONM2	610	110	-1	6.77000	158.540	111.750	54.5100	+
+	97.6000	0.00000	1854.70	0.00000	0.00000	1952.30		
CONM2	611	111	-1	6.66000	158.650	124.900	55.1800	+
+	95.9000	0.00000	1802.80	0.00000	0.00000	1898.70		
CONM2	612	112	-1	6.57000	158.710	138.040	55.8600	+
+	94.6000	0.00000	1760.20	0.00000	0.00000	1854.90		
CONM2	613	113	-1	6.49000	158.770	151.190	56.5400	+
+	93.4000	0.00000	1719.10	0.00000	0.00000	1812.60		
CONM2	614	114	-1	6.41000	158.820	164.340	57.2200	+
+	92.3000	0.00000	1679.50	0.00000	0.00000	1771.80		
CONM2	615	115	-1	6.35000	158.830	177.490	57.9100	+
+	91.5000	0.00000	1646.60	0.00000	0.00000	1738.00		
CONM2	616	116	-1	6.30000	158.820	190.630	58.6000	+
+	90.7000	0.00000	1615.40	0.00000	0.00000	1706.10		
CONM2	617	117	-1	6.26000	158.790	203.780	59.2900	+
+	90.2000	0.00000	1587.80	0.00000	0.00000	1678.00		
CONM2	618	118	-1	6.24000	158.740	216.930	59.9900	+
+	89.8000	0.00000	1563.60	0.00000	0.00000	1653.40		
CONM2	619	119	-1	6.19000	158.660	230.070	60.6900	+
+	88.9000	0.00000	1527.90	0.00000	0.00000	1616.90		
\$	Right wing full fuel masses							
CONM2	620	120	-1	25.3790	157.650	243.200	61.5300	+
+	364.620	0.00000	3931.34	0.00000	0.00000	4090.73		
CONM2	621	121	-1	24.8610	157.570	256.330	62.2300	+
+	357.160	0.00000	3774.54	0.00000	0.00000	3930.40		
CONM2	622	122	-1	24.3480	157.490	269.460	62.9300	+
+	349.800	0.00000	3622.52	0.00000	0.00000	3774.90		
CONM2	623	123	-1	23.3890	157.410	282.590	63.6300	+
+	342.480	0.00000	3475.13	0.00000	0.00000	3624.12		
CONM2	624	124	-1	23.3350	157.330	295.720	64.3300	+
+	335.290	0.00000	3332.35	0.00000	0.00000	3477.95		
CONM2	625	125	-1	22.8390	157.250	308.850	65.0300	+
+	328.150	0.00000	3194.03	0.00000	0.00000	3336.28		
CONM2	626	126	-1	22.3480	157.170	321.980	65.7300	+
+	321.100	0.00000	3060.12	0.00000	0.00000	3199.03		
\$								
\$	Right wing no fuel							
\$								
\$CONM2	620	120	-1	6.14	158.56	243.20	61.53	0 MASS620
\$+MASS620	88.3	0	1485.1	0	0	1573.4		
\$CONM2	621	121	-1	6.10	158.46	256.33	62.23	0 MASS621
\$+MASS621	87.6	0	1443.1	0	0	1530.7		
\$CONM2	622	122	-1	6.05	158.36	269.46	62.93	0 MASS622
\$+MASS622	86.9	0	1402.0	0	0	1488.9		
\$CONM2	623	123	-1	6.00	158.26	282.59	63.63	0 MASS623
\$+MASS623	86.2	0	1361.5	0	0	1447.8		
\$CONM2	624	124	-1	5.95	158.16	295.72	64.33	0 MASS624
\$+MASS624	85.5	0	1321.9	0	0	1407.5		
\$CONM2	625	125	-1	5.91	158.06	308.85	65.03	0 MASS625
\$+MASS625	84.9	0	1283.1	0	0	1367.9		
\$CONM2	626	126	-1	5.86	157.96	321.98	65.73	0 MASS626
\$+MASS626	84.2	0	1245.0	0	0	1329.1		
\$								
\$	Right wing masses (continued)							
CONM2	627	127	-1	5.81000	157.860	335.110	66.3100	+
+	83.5000	0.00000	1207.60	0.00000	0.00000	1291.10		
CONM2	628	128	-1	5.76000	157.760	348.240	67.0100	+
+	82.8000	0.00000	1171.00	0.00000	0.00000	1253.80		
CONM2	629	129	-1	5.72000	157.660	361.370	67.7100	+
+	82.1000	0.00000	1135.20	0.00000	0.00000	1217.30		
CONM2	630	130	-1	5.67000	157.560	374.500	68.4200	+
+	81.5000	0.00000	1100.00	0.00000	0.00000	1181.50		
CONM2	631	131	-1	5.62000	157.460	387.630	69.1200	+

+	80.8000	0.00000	1065.60	0.00000	0.00000	1146.40	
CONM2	632	132	-1	5.58000	157.370	400.760	69.8200
+	80.1000	0.00000	1031.90	0.00000	0.00000	1112.00	
CONM2	633	133	-1	5.53000	157.270	413.890	70.5200
+	79.4000	0.00000	999.000	0.00000	0.00000	1078.40	
CONM2	634	134	-1	5.48000	157.170	427.020	71.2300
+	78.7000	0.00000	966.700	0.00000	0.00000	1045.40	
CONM2	635	135	-1	5.43000	157.070	440.150	71.9300
+	78.1000	0.00000	935.100	0.00000	0.00000	1013.20	
CONM2	636	136	-1	12.3900	155.860	453.280	72.8100
+	77.4000	0.00000	974.400	0.00000	0.00000	974.400	
CONM2	637	137	-1	5.34000	156.870	466.410	73.3300
+	76.7000	0.00000	874.000	0.00000	0.00000	950.700	
CONM2	638	138	-1	12.2900	155.760	479.540	74.1900
+	76.0000	0.00000	912.300	0.00000	0.00000	912.300	
CONM2	639	139	-1	5.24000	156.670	492.670	74.7400
+	75.3000	0.00000	815.600	0.00000	0.00000	890.900	
CONM2	640	140	-1	12.2000	155.670	505.800	75.5800
+	74.7000	0.00000	853.100	0.00000	0.00000	853.100	
CONM2	641	141	-1	5.15000	156.470	518.930	76.1400
+	74.0000	0.00000	759.800	0.00000	0.00000	833.800	
\$	Right wing tip boom masses						
CONM2	702	202	-1	11.2500	33.6100	525.500	77.5000
+	316.500	0.00000	126.600	0.00000	0.00000	126.600	
CONM2	703	203	-1	16.3300	42.2200	525.500	77.5000
+	459.300	0.00000	330.600	0.00000	0.00000	330.600	
CONM2	704	204	-1	16.4100	50.8300	525.500	77.5000
+	461.500	0.00000	332.100	0.00000	0.00000	332.100	
CONM2	705	205	-1	11.4800	59.4400	525.500	77.5000
+	323.000	0.00000	232.500	0.00000	0.00000	232.500	
CONM2	706	206	-1	1.56000	68.0600	525.500	77.5000
+	87.8000	0.00000	53.6000	0.00000	0.00000	53.6000	
CONM2	707	207	-1	1.64000	76.6700	525.500	77.5000
+	92.2000	0.00000	56.2000	0.00000	0.00000	56.2000	
CONM2	708	208	-1	1.72000	85.2800	525.500	77.5000
+	96.5000	0.00000	58.8000	0.00000	0.00000	58.8000	
CONM2	709	209	-1	1.79000	93.8900	525.500	77.5000
+	100.800	0.00000	61.5000	0.00000	0.00000	61.5000	
CONM2	710	210	-1	1.87000	102.500	525.500	77.5000
+	105.100	0.00000	64.1000	0.00000	0.00000	64.1000	
CONM2	711	211	-1	1.95000	111.110	525.500	77.5000
+	109.500	0.00000	66.8000	0.00000	0.00000	66.8000	
CONM2	712	212	-1	2.02000	119.720	525.500	77.5000
+	113.800	0.00000	69.4000	0.00000	0.00000	69.4000	
CONM2	713	213	-1	2.10000	128.330	525.500	77.5000
+	118.100	0.00000	72.0000	0.00000	0.00000	72.0000	
CONM2	714	214	-1	2.18000	136.940	525.500	77.5000
+	122.500	0.00000	74.7000	0.00000	0.00000	74.7000	
CONM2	715	215	-1	2.25000	145.560	525.500	77.5000
+	126.800	0.00000	77.3000	0.00000	0.00000	77.3000	
CONM2	716	216	-1	2.22000	154.170	525.500	77.5000
+	124.800	0.00000	76.1000	0.00000	0.00000	76.1000	
CONM2	717	217	-1	2.18000	162.780	525.500	77.5000
+	122.700	0.00000	74.9000	0.00000	0.00000	74.9000	
CONM2	718	218	-1	5.65000	171.390	525.500	77.5000
+	158.800	0.00000	114.300	0.00000	0.00000	114.300	
CONM2	719	219	-1	2.11000	180.000	525.500	77.5000
+	118.700	0.00000	72.4000	0.00000	0.00000	72.4000	
CONM2	720	220	-1	2.41000	190.000	525.500	77.5000
+	128.900	0.00000	84.6000	0.00000	0.00000	84.6000	
CONM2	721	221	-1	2.35000	200.000	525.500	77.5000
+	119.500	0.00000	79.4000	0.00000	0.00000	79.4000	
CONM2	722	222	-1	2.30000	210.000	525.500	77.5000

+	110.500	0.00000	74.4000	0.00000	0.00000	74.4000		
CONM2	723	223	-1	2.24000	220.000	525.500	77.5000	+
+	101.800	0.00000	69.6000	0.00000	0.00000	69.6000		
CONM2	724	224	-1	2.17000	230.000	525.500	77.5000	+
+	93.6000	0.00000	64.9000	0.00000	0.00000	64.9000		
CONM2	725	225	-1	2.11000	240.000	525.500	77.5000	+
+	85.8000	0.00000	60.5000	0.00000	0.00000	60.5000		
CONM2	726	226	-1	2.05000	250.000	525.500	77.5000	+
+	78.3000	0.00000	56.2000	0.00000	0.00000	56.2000		
CONM2	727	227	-1	1.98000	260.000	525.500	77.5000	+
+	71.3000	0.00000	52.1000	0.00000	0.00000	52.1000		
CONM2	728	228	-1	1.91000	270.000	525.500	77.5000	+
+	64.5000	0.00000	48.2000	0.00000	0.00000	48.2000		
CONM2	729	229	-1	1.84000	280.000	525.500	77.5000	+
+	58.2000	0.00000	44.4000	0.00000	0.00000	44.4000		
CONM2	730	230	-1	1.89000	290.000	525.500	77.5000	+
+	56.0000	0.00000	43.8000	0.00000	0.00000	43.8000		
CONM2	731	231	-1	1.81000	300.000	525.500	77.5000	+
+	50.0000	0.00000	40.1000	0.00000	0.00000	40.1000		
CONM2	732	232	-1	1.73000	310.000	525.500	77.5000	+
+	44.3000	0.00000	36.6000	0.00000	0.00000	36.6000		
CONM2	733	233	-1	1.76000	320.000	525.500	77.5000	+
+	41.8000	0.00000	35.5000	0.00000	0.00000	35.5000		
CONM2	734	234	-1	1.66000	330.000	525.500	77.5000	+
+	36.5000	0.00000	32.1000	0.00000	0.00000	32.1000		
CONM2	735	235	-1	1.56000	340.000	525.500	77.5000	+
+	31.6000	0.00000	28.8000	0.00000	0.00000	28.8000		
CONM2	736	236	-1	1.56000	350.000	525.500	77.5000	+
+	29.0000	0.00000	27.5000	0.00000	0.00000	27.5000		
CONM2	737	237	-1	1.54000	360.000	525.500	77.5000	+
+	26.2000	0.00000	26.0000	0.00000	0.00000	26.0000		
CONM2	738	238	-1	1.42000	370.000	525.500	77.5000	+
+	21.9000	0.00000	22.8000	0.00000	0.00000	22.8000		
CONM2	739	239	-1	1.37000	380.000	525.500	77.5000	+
+	19.3000	0.00000	21.1000	0.00000	0.00000	21.1000		
CONM2	740	240	-1	1.31000	390.000	525.500	77.5000	+
+	16.6000	0.00000	19.2000	0.00000	0.00000	19.2000		
CONM2	741	241	-1	1.29000	400.000	525.500	77.5000	+
+	14.7000	0.00000	18.1000	0.00000	0.00000	18.1000		
CONM2	742	242	-1	0.80000	410.000	525.500	77.5000	+
+	8.10000	0.00000	10.7000	0.00000	0.00000	10.7000		
CONM2	743	243	-1	0.71000	420.000	525.500	77.5000	+
+	6.40000	0.00000	9.10000	0.00000	0.00000	9.10000		
\$	Right half horizontal tail masses							
CONM2	802	302	-1	4.97000	387.100	530.250	77.8000	+
+	37.4000	0.00000	1504.70	0.00000	0.00000	1542.10		
CONM2	803	303	-1	4.73000	386.660	539.750	79.4700	+
+	35.6000	0.00000	1289.20	0.00000	0.00000	1324.70		
CONM2	804	304	-1	7.69000	387.790	549.250	81.0600	+
+	33.8000	0.00000	1149.50	0.00000	0.00000	1149.50		
CONM2	805	305	-1	4.26000	385.750	558.750	82.8200	+
+	32.0000	0.00000	923.600	0.00000	0.00000	955.600		
CONM2	806	306	-1	4.03000	385.290	568.250	84.4900	+
+	30.3000	0.00000	770.900	0.00000	0.00000	801.200		
CONM2	807	307	-1	7.00000	387.180	577.750	86.0400	+
+	28.6000	0.00000	710.000	0.00000	0.00000	710.000		
CONM2	808	308	-1	3.58000	384.330	587.250	87.8400	+
+	26.9000	0.00000	519.200	0.00000	0.00000	546.100		
CONM2	809	309	-1	3.35000	383.830	596.750	89.5100	+
+	25.2000	0.00000	417.600	0.00000	0.00000	442.800		
CONM2	810	310	-1	6.34000	386.700	606.250	91.0100	+
+	23.6000	0.00000	427.700	0.00000	0.00000	427.700		
CONM2	811	311	-1	2.92000	382.810	615.750	92.8700	+

+	22.0000	0.00000	256.700	0.00000	0.00000	278.700	
\$	Right half vertical tail masses						
CONM2	902	402	-1	3.06000	413.630	524.050	81.4800 +
+	18.3000	0.00000	616.300	0.00000	0.00000	597.900	
CONM2	903	403	-1	2.91000	414.650	521.150	89.4500 +
+	17.5000	0.00000	547.100	0.00000	0.00000	529.700	
CONM2	904	404	-1	5.97000	418.340	518.250	97.4200 +
+	16.6000	0.00000	483.700	0.00000	0.00000	467.100	
CONM2	905	405	-1	2.63000	416.670	515.350	105.390 +
+	15.8000	0.00000	425.800	0.00000	0.00000	410.000	
CONM2	906	406	-1	2.49000	417.670	512.450	113.360 +
+	14.9000	0.00000	373.100	0.00000	0.00000	358.200	
CONM2	907	407	-1	2.36000	418.660	509.550	121.330 +
+	14.1000	0.00000	325.300	0.00000	0.00000	311.200	
CONM2	908	408	-1	5.43000	422.590	506.650	129.300 +
+	13.3000	0.00000	282.300	0.00000	0.00000	269.000	
CONM2	909	409	-1	2.10000	420.610	503.750	137.270 +
+	12.6000	0.00000	243.700	0.00000	0.00000	231.100	
CONM2	910	410	-1	1.98000	421.570	500.850	145.230 +
+	11.8000	0.00000	209.300	0.00000	0.00000	197.500	
CONM2	911	411	-1	1.86000	422.500	497.950	153.200 +
+	11.1000	0.00000	178.900	0.00000	0.00000	167.800	
\$	Left half wing masses						
CONM2	3105	3000	-1	7.91000	157.540-6.57000	49.1600	+
+	114.000	0.00000	2357.10	0.00000	0.00000	2471.10	
CONM2	3106	3001	-1	7.75000	157.670-19.7200	49.8300	+
+	111.700	0.00000	2285.60	0.00000	0.00000	2397.20	
CONM2	3107	3002	-1	7.60000	157.800-32.8700	50.5000	+
+	109.400	0.00000	2216.70	0.00000	0.00000	2326.10	
CONM2	3108	3003	-1	7.45000	157.920-46.0100	51.1700	+
+	107.300	0.00000	2150.30	0.00000	0.00000	2257.60	
CONM2	3109	3004	-1	7.30000	158.050-59.1600	51.8400	+
+	105.200	0.00000	2086.50	0.00000	0.00000	2191.60	
CONM2	3110	3005	-1	7.16000	158.170-72.3100	52.5100	+
+	103.200	0.00000	2025.00	0.00000	0.00000	2128.20	
CONM2	3111	3006	-1	7.03000	158.300-85.4600	53.1700	+
+	101.200	0.00000	1966.00	0.00000	0.00000	2067.20	
CONM2	3112	3007	-1	6.90000	158.420-98.6000	53.8400	+
+	99.4000	0.00000	1909.20	0.00000	0.00000	2008.60	
CONM2	3113	3008	-1	6.77000	158.540-111.750	54.5100	+
+	97.6000	0.00000	1854.70	0.00000	0.00000	1952.30	
CONM2	3114	3009	-1	6.66000	158.650-124.900	55.1800	+
+	95.9000	0.00000	1802.80	0.00000	0.00000	1898.70	
CONM2	3115	3010	-1	6.57000	158.710-138.040	55.8600	+
+	94.6000	0.00000	1760.20	0.00000	0.00000	1854.90	
CONM2	3116	3011	-1	6.49000	158.770-151.190	56.5400	+
+	93.4000	0.00000	1719.10	0.00000	0.00000	1812.60	
CONM2	3117	3012	-1	6.41000	158.820-164.340	57.2200	+
+	92.3000	0.00000	1679.50	0.00000	0.00000	1771.80	
CONM2	3118	3013	-1	6.35000	158.830-177.490	57.9100	+
+	91.5000	0.00000	1646.60	0.00000	0.00000	1738.00	
CONM2	3119	3014	-1	6.30000	158.820-190.630	58.6000	+
+	90.7000	0.00000	1615.40	0.00000	0.00000	1706.10	
CONM2	3120	3015	-1	6.26000	158.790-203.780	59.2900	+
+	90.2000	0.00000	1587.80	0.00000	0.00000	1678.00	
CONM2	3121	3016	-1	6.24000	158.740-216.930	59.9900	+
+	89.8000	0.00000	1563.60	0.00000	0.00000	1653.40	
CONM2	3122	3017	-1	6.19000	158.660-230.070	60.6900	+
+	88.9000	0.00000	1527.90	0.00000	0.00000	1616.90	
\$	Left wing full fuel condition						
CONM2	3123	3018	-1	25.3790	157.650-243.200	61.5300	+
+	364.620	0.00000	3931.34	0.00000	0.00000	4090.73	

CONM2	3124	3019	-1	24.8610	157.570-256.330	62.2300	+
+	357.160	0.00000	3774.54	0.00000	0.00000	3930.40	
CONM2	3125	3020	-1	24.3480	157.490-269.460	62.9300	+
+	349.800	0.00000	3622.52	0.00000	0.00000	3774.90	
CONM2	3126	3021	-1	23.3890	157.410-282.590	63.6300	+
+	342.480	0.00000	3475.13	0.00000	0.00000	3624.12	
CONM2	3127	3022	-1	23.3350	157.330-295.720	64.3300	+
+	335.290	0.00000	3332.35	0.00000	0.00000	3477.95	
CONM2	3128	3023	-1	22.8390	157.250-308.850	65.0300	+
+	328.150	0.00000	3194.03	0.00000	0.00000	3336.28	
CONM2	3129	3024	-1	22.3480	157.170-321.980	65.7300	+
+	321.100	0.00000	3060.12	0.00000	0.00000	3199.03	
\$	End of full fuel masses for left wing						
\$							
\$	Left wing fuel empty condition						
\$							
\$CONM2	3123	3018	-1	6.14	158.56 -243.20	61.53	0 MAS3123
+\$MAS3123	88.3	0	1485.1	0	0	1573.4	
\$CONM2	3124	3019	-1	6.10	158.46 -256.33	62.23	0 MAS3124
+\$MAS3124	87.6	0	1443.1	0	0	1530.7	
\$CONM2	3125	3020	-1	6.05	158.36 -269.46	62.93	0 MAS3125
+\$MAS3125	86.9	0	1402.0	0	0	1488.9	
\$CONM2	3126	3021	-1	6.00	158.26 -282.59	63.63	0 MAS3126
+\$MAS3126	86.2	0	1361.5	0	0	1447.8	
\$CONM2	3127	3022	-1	5.95	158.16 -295.72	64.33	0 MAS3127
+\$MAS3127	85.5	0	1321.9	0	0	1407.5	
\$CONM2	3128	3023	-1	5.91	158.06 -308.85	65.03	0 MAS3128
+\$MAS3128	84.9	0	1283.1	0	0	1367.9	
\$CONM2	3129	3024	-1	5.86	157.96 -321.98	65.73	0 MAS3129
+\$MAS3129	84.2	0	1245.0	0	0	1329.1	
\$	End of left wing fuel empty condition						
\$							
\$	Left wing masses (continued)						
CONM2	3130	3025	-1	5.81000	157.860-335.110	66.3100	+
+	83.5000	0.00000	1207.60	0.00000	0.00000	1291.10	
CONM2	3131	3026	-1	5.76000	157.760-348.240	67.0100	+
+	82.8000	0.00000	1171.00	0.00000	0.00000	1253.80	
CONM2	3132	3027	-1	5.72000	157.660-361.370	67.7100	+
+	82.1000	0.00000	1135.20	0.00000	0.00000	1217.30	
CONM2	3133	3028	-1	5.67000	157.560-374.500	68.4200	+
+	81.5000	0.00000	1100.00	0.00000	0.00000	1181.50	
CONM2	3134	3029	-1	5.62000	157.460-387.630	69.1200	+
+	80.8000	0.00000	1065.60	0.00000	0.00000	1146.40	
CONM2	3135	3030	-1	5.58000	157.370-400.760	69.8200	+
+	80.1000	0.00000	1031.90	0.00000	0.00000	1112.00	
CONM2	3136	3031	-1	5.53000	157.270-413.890	70.5200	+
+	79.4000	0.00000	999.000	0.00000	0.00000	1078.40	
CONM2	3137	3032	-1	5.48000	157.170-427.020	71.2300	+
+	78.7000	0.00000	966.700	0.00000	0.00000	1045.40	
CONM2	3138	3033	-1	5.43000	157.070-440.150	71.9300	+
+	78.1000	0.00000	935.100	0.00000	0.00000	1013.20	
CONM2	3139	3034	-1	12.3900	155.860-453.280	72.8100	+
+	77.4000	0.00000	974.400	0.00000	0.00000	974.400	
CONM2	3140	3035	-1	5.34000	156.870-466.410	73.3300	+
+	76.7000	0.00000	874.000	0.00000	0.00000	950.700	
CONM2	3141	3036	-1	12.2900	155.760-479.540	74.1900	+
+	76.0000	0.00000	912.300	0.00000	0.00000	912.300	
CONM2	3142	3037	-1	5.24000	156.670-492.670	74.7400	+
+	75.3000	0.00000	815.600	0.00000	0.00000	890.900	
CONM2	3143	3038	-1	12.2000	155.670-505.800	75.5800	+
+	74.7000	0.00000	853.100	0.00000	0.00000	853.100	
CONM2	3144	3039	-1	5.15000	156.470-518.930	76.1400	+
+	74.0000	0.00000	759.800	0.00000	0.00000	833.800	

\$	Left half wing tip boom masses							
CONM2	3145	3041	-1	11.2500	33.6100-525.500	77.5000		+
+	316.500	0.00000	126.600	0.00000	0.00000	126.600		
CONM2	3146	3042	-1	16.3300	42.2200-525.500	77.5000		+
+	459.300	0.00000	330.600	0.00000	0.00000	330.600		
CONM2	3147	3043	-1	16.4100	50.8300-525.500	77.5000		+
+	461.500	0.00000	332.100	0.00000	0.00000	332.100		
CONM2	3148	3044	-1	11.4800	59.4400-525.500	77.5000		+
+	323.000	0.00000	232.500	0.00000	0.00000	232.500		
CONM2	3149	3045	-1	1.56000	68.0600-525.500	77.5000		+
+	87.8000	0.00000	53.6000	0.00000	0.00000	53.6000		
CONM2	3150	3046	-1	1.64000	76.6700-525.500	77.5000		+
+	92.2000	0.00000	56.2000	0.00000	0.00000	56.2000		
CONM2	3151	3047	-1	1.72000	85.2800-525.500	77.5000		+
+	96.5000	0.00000	58.8000	0.00000	0.00000	58.8000		
CONM2	3152	3048	-1	1.79000	93.8900-525.500	77.5000		+
+	100.800	0.00000	61.5000	0.00000	0.00000	61.5000		
CONM2	3153	3049	-1	1.87000	102.500-525.500	77.5000		+
+	105.100	0.00000	64.1000	0.00000	0.00000	64.1000		
CONM2	3154	3050	-1	1.95000	111.110-525.500	77.5000		+
+	109.500	0.00000	66.8000	0.00000	0.00000	66.8000		
CONM2	3155	3051	-1	2.02000	119.720-525.500	77.5000		+
+	113.800	0.00000	69.4000	0.00000	0.00000	69.4000		
CONM2	3156	3052	-1	2.10000	128.330-525.500	77.5000		+
+	118.100	0.00000	72.0000	0.00000	0.00000	72.0000		
CONM2	3157	3053	-1	2.18000	136.940-525.500	77.5000		+
+	122.500	0.00000	74.7000	0.00000	0.00000	74.7000		
CONM2	3158	3054	-1	2.25000	145.560-525.500	77.5000		+
+	126.800	0.00000	77.3000	0.00000	0.00000	77.3000		
CONM2	3159	3055	-1	2.22000	154.170-525.500	77.5000		+
+	124.800	0.00000	76.1000	0.00000	0.00000	76.1000		
CONM2	3160	3056	-1	2.18000	162.780-525.500	77.5000		+
+	122.700	0.00000	74.9000	0.00000	0.00000	74.9000		
CONM2	3161	3057	-1	5.65000	171.390-525.500	77.5000		+
+	158.800	0.00000	114.300	0.00000	0.00000	114.300		
CONM2	3162	3058	-1	2.11000	180.000-525.500	77.5000		+
+	118.700	0.00000	72.4000	0.00000	0.00000	72.4000		
CONM2	3163	3059	-1	2.41000	190.000-525.500	77.5000		+
+	128.900	0.00000	84.6000	0.00000	0.00000	84.6000		
CONM2	3164	3060	-1	2.35000	200.000-525.500	77.5000		+
+	119.500	0.00000	79.4000	0.00000	0.00000	79.4000		
CONM2	3165	3061	-1	2.30000	210.000-525.500	77.5000		+
+	110.500	0.00000	74.4000	0.00000	0.00000	74.4000		
CONM2	3166	3062	-1	2.24000	220.000-525.500	77.5000		+
+	101.800	0.00000	69.6000	0.00000	0.00000	69.6000		
CONM2	3167	3063	-1	2.17000	230.000-525.500	77.5000		+
+	93.6000	0.00000	64.9000	0.00000	0.00000	64.9000		
CONM2	3168	3064	-1	2.11000	240.000-525.500	77.5000		+
+	85.8000	0.00000	60.5000	0.00000	0.00000	60.5000		
CONM2	3169	3065	-1	2.05000	250.000-525.500	77.5000		+
+	78.3000	0.00000	56.2000	0.00000	0.00000	56.2000		
CONM2	3170	3066	-1	1.98000	260.000-525.500	77.5000		+
+	71.3000	0.00000	52.1000	0.00000	0.00000	52.1000		
CONM2	3171	3067	-1	1.91000	270.000-525.500	77.5000		+
+	64.5000	0.00000	48.2000	0.00000	0.00000	48.2000		
CONM2	3172	3068	-1	1.84000	280.000-525.500	77.5000		+
+	58.2000	0.00000	44.4000	0.00000	0.00000	44.4000		
CONM2	3173	3069	-1	1.89000	290.000-525.500	77.5000		+
+	56.0000	0.00000	43.8000	0.00000	0.00000	43.8000		
CONM2	3174	3070	-1	1.81000	300.000-525.500	77.5000		+
+	50.0000	0.00000	40.1000	0.00000	0.00000	40.1000		
CONM2	3175	3071	-1	1.73000	310.000-525.500	77.5000		+
+	44.3000	0.00000	36.6000	0.00000	0.00000	36.6000		

CONM2	3176	3072	-1	1.76000	320.000-525.500	77.5000	+
+	41.8000	0.00000	35.5000	0.00000	0.00000	35.5000	
CONM2	3177	3073	-1	1.66000	330.000-525.500	77.5000	+
+	36.5000	0.00000	32.1000	0.00000	0.00000	32.1000	
CONM2	3178	3074	-1	1.56000	340.000-525.500	77.5000	+
+	31.6000	0.00000	28.8000	0.00000	0.00000	28.8000	
CONM2	3179	3075	-1	1.56000	350.000-525.500	77.5000	+
+	29.0000	0.00000	27.5000	0.00000	0.00000	27.5000	
CONM2	3180	3076	-1	1.54000	360.000-525.500	77.5000	+
+	26.2000	0.00000	26.0000	0.00000	0.00000	26.0000	
CONM2	3181	3077	-1	1.42000	370.000-525.500	77.5000	+
+	21.9000	0.00000	22.8000	0.00000	0.00000	22.8000	
CONM2	3182	3078	-1	1.37000	380.000-525.500	77.5000	+
+	19.3000	0.00000	21.1000	0.00000	0.00000	21.1000	
CONM2	3183	3079	-1	1.31000	390.000-525.500	77.5000	+
+	16.6000	0.00000	19.2000	0.00000	0.00000	19.2000	
CONM2	3184	3080	-1	1.29000	400.000-525.500	77.5000	+
+	14.7000	0.00000	18.1000	0.00000	0.00000	18.1000	
CONM2	3185	3081	-1	0.80000	410.000-525.500	77.5000	+
+	8.10000	0.00000	10.7000	0.00000	0.00000	10.7000	
CONM2	3186	3082	-1	0.71000	420.000-525.500	77.5000	+
+	6.40000	0.00000	9.10000	0.00000	0.00000	9.10000	
\$	Left half horizontal tail masses						
CONM2	3187	3084	-1	4.97000	387.100-530.250	77.8000	+
+	37.4000	0.00000	1504.70	0.00000	0.00000	1542.10	
CONM2	3188	3085	-1	4.73000	386.660-539.750	79.4700	+
+	35.6000	0.00000	1289.20	0.00000	0.00000	1324.70	
CONM2	3189	3086	-1	7.69000	387.790-549.250	81.0600	+
+	33.8000	0.00000	1149.50	0.00000	0.00000	1149.50	
CONM2	3190	3087	-1	4.26000	385.750-558.750	82.8200	+
+	32.0000	0.00000	923.600	0.00000	0.00000	955.600	
CONM2	3191	3088	-1	4.03000	385.290-568.250	84.4900	+
+	30.3000	0.00000	770.900	0.00000	0.00000	801.200	
CONM2	3192	3089	-1	7.00000	387.180-577.750	86.0400	+
+	28.6000	0.00000	710.000	0.00000	0.00000	710.000	
CONM2	3193	3090	-1	3.58000	384.330-587.250	87.8400	+
+	26.9000	0.00000	519.200	0.00000	0.00000	546.100	
CONM2	3194	3091	-1	3.35000	383.830-596.750	89.5100	+
+	25.2000	0.00000	417.600	0.00000	0.00000	442.800	
CONM2	3195	3092	-1	6.34000	386.700-606.250	91.0100	+
+	23.6000	0.00000	427.700	0.00000	0.00000	427.700	
CONM2	3196	3093	-1	2.92000	382.810-615.750	92.8700	+
+	22.0000	0.00000	256.700	0.00000	0.00000	278.700	
\$	Left half vertical tail masses						
CONM2	3197	3095	-1	3.06000	413.630-524.050	81.4800	+
+	18.3000	0.00000	616.300	0.00000	0.00000	597.900	
CONM2	3198	3096	-1	2.91000	414.650-521.150	89.4500	+
+	17.5000	0.00000	547.100	0.00000	0.00000	529.700	
CONM2	3199	3097	-1	5.97000	418.340-518.250	97.4200	+
+	16.6000	0.00000	483.700	0.00000	0.00000	467.100	
CONM2	3200	3098	-1	2.63000	416.670-515.350	105.390	+
+	15.8000	0.00000	425.800	0.00000	0.00000	410.000	
CONM2	3201	3099	-1	2.49000	417.670-512.450	113.360	+
+	14.9000	0.00000	373.100	0.00000	0.00000	358.200	
CONM2	3202	3100	-1	2.36000	418.660-509.550	121.330	+
+	14.1000	0.00000	325.300	0.00000	0.00000	311.200	
CONM2	3203	3101	-1	5.43000	422.590-506.650	129.300	+
+	13.3000	0.00000	282.300	0.00000	0.00000	269.000	
CONM2	3204	3102	-1	2.10000	420.610-503.750	137.270	+
+	12.6000	0.00000	243.700	0.00000	0.00000	231.100	
CONM2	3205	3103	-1	1.98000	421.570-500.850	145.230	+
+	11.8000	0.00000	209.300	0.00000	0.00000	197.500	
CONM2	3206	3104	-1	1.86000	422.500-497.950	153.200	+

```

+      11.1000 0.00000 178.900 0.00000 0.00000 167.800
$

```

• **Program full_aero.dat**

```

$      ***** DEFINE AERODYNAMIC PANELS FOR RIGHT SIDE *****
$      RIGHT-SIDE INBOARD WING
CAERO1  10001  1      0      17      8      1      +CA101
+CA101  132.83  0.0    48.98  59.2    134.33  223.5    60.77  54.03

$      RIGHT-SIDE OUTBOARD WING
CAERO1  20001  1      0      23      8      1      +CA102
+CA102  134.33  223.5    60.77  54.03    138.03  525.5    76.79  41.28

$
$      RIGHT-SIDE HORIZONTAL TAIL UP TO THE HINGE LINE
CAERO1  30001  1      0      20      8      1      +CA103
+CA103  355.08  525.5    77.36  49.40    366.04  620.5    93.92  24.704

$
$      RIGHT-SIDE CONTROL SURFACE PANEL ON HORIZONTAL TAIL
CAERO1  31001  1      0      20      2      1      +CA103A
+CA103A 404.480 525.50  77.360 12.35    390.744 620.50  93.920 6.176

$
$      RIGHT-SIDE VERTICAL TAIL UP TO THE HINGE LINE
CAERO1  40001  1      0      20      8      1      +CA104
+CA104  407.54  496.5    157.19  25.60    390.67  525.5    77.5    39.44

$
$      RIGHT-SIDE CONTROL SURFACE PANEL ON VERTICAL TAIL
CAERO1  41001  1      0      20      2      1      +CA104A
+CA104A 433.140 496.50  157.190 6.40    430.110 525.50  77.50  9.86

$
$      ***** BEGIN LEFT SIDE AERODYNAMIC PANEL DEFINITION *****
$      LEFT-SIDE INBOARD WING
CAERO1  51001  1      0      17      8      1      +CA110
+CA110  134.33 -223.50  60.77  54.03    132.83  0.0    48.98  59.20

$      LEFT-SIDE OUTBOARD WING
CAERO1  61001  1      0      23      8      1      +CA210
+CA210  138.03 -525.50  76.79  41.28    134.33 -223.50  60.77  54.03

$      LEFT-SIDE HORIZONTAL TAIL FROM LEADING EDGE TO HINGE LINE
CAERO1  72001  1      0      20      8      1      +CA307
+CA307  366.04 -620.50  93.92  24.704  355.08 -525.50  77.36  49.40

$      CONTROL SURFACE ON LEFT-SIDE HORIZONTAL TAIL
CAERO1  73001  1      0      20      2      1      +CA315
+CA315  390.744 -620.50  93.92  6.176  404.48 -525.50  77.36  12.35

$      LEFT-SIDE VERTICAL TAIL FROM LEADING EDGE TO HINGE LINE
CAERO1  82001  1      0      20      8      1      +CA407
+CA407  390.670 -525.50  77.50  39.44  407.54 -496.50  157.19  25.60

$      CONTROL SURFACE ON LEFT-SIDE VERTICAL TAIL
CAERO1  83001  1      0      20      2      1      +CA415
+CA415  430.110 -525.50  77.50  9.86  433.14 -496.50  157.19  6.40

```

• **Program full_spline.dat**

```

$
$      USE SURFACE SPLINES ON ALL LIFTING SURFACES
$      SPLINE1 = 100    RIGHT-SIDE INBOARD WING
$      SPLINE1 = 110    LEFT-SIDE INBOARD WING
$      SPLINE1 = 200    RIGHT-SIDE OUTBOARD WING
$      SPLINE1 = 210    LEFT-SIDE OUTBOARD WING
$      SPLINE1 = 300    RIGHT-SIDE HORIZONTAL TAIL WITHOUT CONTROL SURFACE
$      SPLINE1 = 310    LEFT-SIDE HORIZONTAL TAIL WITHOUT CONTROL SURFACE
$      SPLINE1 = 350    RIGHT-SIDE CONTROL SURFACE ON HORIZONTAL TAIL
$      SPLINE1 = 360    LEFT-SIDE CONTROL SURFACE ON HORIZONTAL TAIL

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```

$   SPLINE1 = 400   RIGHT-SIDE VERTICAL TAIL WITHOUT CONTROL SURFACE
$   SPLINE1 = 410   LEFT-SIDE VERTICAL TAIL WITHOUT CONTROL SURFACE
$   SPLINE1 = 450   RIGHT-SIDE CONTROL SURFACE ON VERTICAL TAIL
$   SPLINE1 = 460   LEFT-SIDE CONTROL SURFACE ON VERTICAL TAIL
$
$   RIGHT-SIDE SURFACE SPLINE PARAMETERS
$
SPLINE1 100      10001   10001   10136   100
SPLINE1 200      20001   20001   20184   200
$
SPLINE1 300      30001   30001   30160   300
SPLINE1 400      40001   40001   40160   400
$
SPLINE1 350      31001   31001   31040   350
SPLINE1 450      41001   41001   41040   450
$
$   LEFT-SIDE SURFACE SPLINE PARAMETERS
$
SPLINE1 110      51001   51001   51136   110
SPLINE1 210      61001   61001   61184   210
$
SPLINE1 310      72001   72001   72160   310
SPLINE1 410      82001   82001   82160   410
$
SPLINE1 360      73001   73001   73040   360
SPLINE1 460      83001   83001   83040   460
$
$   GRIDS UTILIZED FOR RIGHT SIDE INBOARD WING SURFACE SPLINES
SET1      100      101      102      103      104      105      106      107+RIW01
+RIW01    108      109      110      111      112      113      114      115+RIW02
+RIW02    116      117      118      1101     1102     1103     1104     1105+RIW03
+RIW03    1106     1107     1108     1109     1110     1111     1112     1113+RIW04
+RIW04    1114     1115     1116     1117     1118     2101     2102     2103+RIW05
+RIW05    2104     2105     2106     2107     2108     2109     2110     2111+RIW06
+RIW06    2112     2113     2114     2115     2116     2117     2118
$   GRIDS UTILIZED FOR RIGHT SIDE OUTBOARD WING SURFACE SPLINES
SET1      200      118      119      120      121      122      123      124+ROW01
+ROW01    125      126      127      128      129      130      131      132+ROW02
+ROW02    133      134      135      136      137      138      139      140+ROW03
+ROW03    141      1118     1119     1120     1121     1122     1123     1124+ROW04
+ROW04    1125     1126     1127     1128     1129     1130     1131     1132+ROW05
+ROW05    1133     1134     1135     1136     1137     1138     1139     1140+ROW06
+ROW06    1141     2118     2119     2120     2121     2122     2123     2124+ROW07
+ROW07    2125     2126     2127     2128     2129     2130     2131     2132+ROW08
+ROW08    2133     2134     2135     2136     2137     2138     2139     2140+ROW09
+ROW09    2141
$   GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON H-TAIL
SET1      300      301      302      303      304      305      306      307+RHT01
+RHT01    308      309      310      311      1301     1302     1303     1304+RHT02
+RHT02    1305     1306     1307     1308     1309     1310     1311     2501+RHT03
+RHT03    2502     2503     2504     2505     2506     2507     2508     2509+RHT04
+RHT04    2510     2511
$   GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON H-TAIL CONTROL SURFACE
SET1      350      2501     2502     2503     2504     2505     2506     2507+RHC01
+RHC01    2508     2509     2510     2511     2301     2302     2303     2304+RHC02
+RHC02    2305     2306     2307     2308     2309     2310     2311
$   GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON V-TAIL
SET1      400      401      402      403      404      405      406      407+RVT01
+RVT01    408      409      410      411      1401     1402     1403     1404+RVT02
+RVT02    1405     1406     1407     1408     1409     1410     1411     2601+RVT03
+RVT03    2602     2603     2604     2605     2606     2607     2608     2609+RVT04
+RVT04    2610     2611
$   GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON V-TAIL CONTROL SURFACE

```

SET1	450	2601	2602	2603	2604	2605	2606	2607+RVC01
+RVC01	2608	2609	2610	2611	2401	2402	2403	2404+RVC02
+RVC02	2405	2406	2407	2408	2409	2410	2411	

\$

\$ GRIDS UTILIZED FOR LEFT-SIDE INBOARD WING SURFACE SPLINE

SET1	110	101	1101	2101	3000	3001	3002	3003+LIW01
+LIW01	3004	3005	3006	3007	3008	3009	3010	3011+LIW02
+LIW02	3012	3013	3014	3015	3016	3105	3106	3107+LIW03
+LIW03	3108	3109	3110	3111	3112	3113	3114	3115+LIW04
+LIW04	3116	3117	3118	3119	3120	3121	3167	3168+LIW05
+LIW05	3169	3170	3171	3172	3173	3174	3175	3176+LIW06
+LIW06	3177	3178	3179	3180	3181	3182	3183	

\$

SET1	210	3016	3017	3018	3019	3020	3021	3022+LOW01
+LOW01	3023	3024	3025	3026	3027	3028	3029	3030+LOW02
+LOW02	3031	3032	3033	3034	3035	3036	3037	3038+LOW03
+LOW03	3039	3121	3122	3123	3124	3125	3126	3127+LOW04
+LOW04	3128	3129	3130	3131	3132	3133	3134	3135+LOW05
+LOW05	3136	3137	3138	3139	3140	3141	3142	3143+LOW06
+LOW06	3144	3183	3184	3185	3186	3187	3188	3189+LOW07
+LOW07	3190	3191	3192	3193	3194	3195	3196	3197+LOW08
+LOW08	3198	3199	3200	3201	3202	3203	3204	3205+LOW09
+LOW09	3206							

\$

SET1	310	3083	3084	3085	3086	3087	3088	3089+LHT01
+LHT01	3090	3091	3092	3093	3145	3146	3147	3148+LHT02
+LHT02	3149	3150	3151	3152	3153	3154	3155	3401+LHT03
+LHT03	3402	3403	3404	3405	3406	3407	3408	3409+LHT04
+LHT04	3410	3411						

\$

SET1	360	3401	3402	3403	3404	3405	3406	3407+LHC01
+LHC01	3408	3409	3410	3411	3207	3208	3209	3210+LHC02
+LHC02	3211	3212	3213	3214	3215	3216	3217	

\$

SET1	410	3094	3095	3096	3097	3098	3099	3100+LVT01
+LVT01	3101	3102	3103	3104	3156	3157	3158	3159+LVT02
+LVT02	3160	3161	3162	3163	3164	3165	3166	3501+LVT03
+LVT03	3502	3503	3504	3505	3506	3507	3508	3509+LVT04
+LVT04	3510	3511						

\$

SET1	460	3501	3502	3503	3504	3505	3506	3507+LVC01
+LVC01	3508	3509	3510	3511	3218	3219	3220	3221+LVC02
+LVC02	3222	3223	3224	3225	3226	3227	3228	

• Program alterv4.dat

```

compile seaero list ref
ALTER 'IF ( EXTRCV=0 ) THEN',''
ALTER 'CALL SESUM '(1,+2),''
ALTER 'IF ( NOT(NOPH2 OR SAVERSTL) ) THEN',''
ALTER 'IF ( FOURIER ) THEN'(1,-3),''(1,-1)
ALTER 'CALL FDRMGEN USET,VGFD'(1,-1),''
$ALTER 'DELETE /QHH,QHJ,QKH,',''
ALTER 'TYPE PARM,,I,N,KCNT=1,CNTR=0,NOMKLIST=1,NUMI','' $
TYPE PARM,,I,N,KCNT,CNTR,NOMKLIST,NUMI $
TYPE PARM,,I,N,NSKIPPDF $
TYPE PARM,,I,Y,NSTRIPRM $
ALTER 'IF ( OPPHIB>=0 OR OPPHIPA>=0'
ENDIF $ NOEDTS>0
NSKIPPDF=0 $ INITIALIZE
COPY AERO/AEROTEMP/ALWAYS/-1 $
COPY CASES/CASETEMP/ALWAYS/-1 $
DO WHILE (NSKIPPDF<NSTRIPRM ) THEN $
NSKIPPDF=NSKIPPDF+1 $

```

```

$ CASE CASECC,/CASE1/'TRAN'/S,N,NSKIPPDF $
$ PVT PVT,CASE1// $
$ PARAML CASE1//DTI'/1/1//S,N,SUBID $
MESSAGE //' NSKIPPDF='/NSKIPPDF $
CNTR=0 $ INITIALIZE
KCNT=1 $ INITIALIZE
NOMKLIST=1 $ INITIALIZE
DELETE /AERO,CASES,,, $
COPY AEROTEMP/AERO/ALWAYS/-1 $
COPY CASETEMP/CASES/ALWAYS/-1 $
DELETE /QHHL,QHJL,QKHL,, $
DELETE /QHHA,QHJA,QKHA,, $
$DELETE /QHH,QHJ,QKH,, $
DELETE /PPF,FOL,AUPF,AQPF,AQMPF $
DELETE /AUHF,QMGF,QSGF,PHF, $
DELETE /FOL1,PPF1,AULF,PSF1,AUHF1 $
DELETE /IUG1,IQG1,IEF1,IES1,IEE1 $
DELETE /IUG2,IQG2,IEF2,IES2,IEE2 $
ALTER 'CALL SUPER3 CASECC , ,AULF'
ENDDO $ NSKIPPDFX>=0
ALTER 'AMP AJJO' $
DMIIN DMI,DMINDX/ISTRIP,,,,,,,,/ $ USE MATRIX ISTRIP DEFINED IN DMI
MATMOD ISTRIP,,,,/ISTRIP1COL,/1/NSKIPPDF $ SELECTS THE COLUMN FROM ISTRIP
$ $ BY THE INDEX NSTRIIPRM
MATMOD ISTRIP1COL,,,,/ISTRIPDIAG,/28 $ DIAGONALIZES THE ABOVE SELECTED COLUMN
$ MPYAD ISTRIP,QHJ,/QHJTEMP/ $ CREATE THE NEW QHJ CORRESPONDING TO THE STRIP
MPYAD ISTRIPDIAG,QHJ,/QHJTEMP/ $ CREATE THE NEW QHJ CORRESPONDING TO THE STRIP
DELETE /QHJ,,, $
ADD QHJTEMP,/QHJ $
$matprn QHJ// $
ALTER 'MATMOD AERO,QHHA,,,,/QHHL,/22'(1,-2)
MESSAGE //' KCNT='/KCNT/' NOMKLIST='/NOMKLIST/
' DOAMP='/ DOAMP $
ALTER 'DOAMP = (NOQHH','IF ( DOAMP ) THEN'
MESSAGE //' NOQHJ='/NOQHJ/' NOQHH='/NOQHH/
' GUSTAERO='/ GUSTAERO $
ALTER 'SDR1 ,,,QHJ,,,,,,,,/QHJA,/CNTR/'(1,+1),'
endalter $

```

• Program strip1440_left

\$dmi	istrip	0	2	2	2	M rows	N cols
dmi	istrip	0	2	2	2	1440	80
\$left inner wing, out to in							
dmi	istrip	1	7211.0D0	thru		728	
dmi	istrip	2	7291.0D0	thru		736	
dmi	istrip	3	7371.0D0	thru		744	
dmi	istrip	4	7451.0D0	thru		752	
dmi	istrip	5	7531.0D0	thru		760	
dmi	istrip	6	7611.0D0	thru		768	
dmi	istrip	7	7691.0D0	thru		776	
dmi	istrip	8	7771.0D0	thru		784	
dmi	istrip	9	7851.0D0	thru		792	
dmi	istrip	10	7931.0D0	thru		800	
dmi	istrip	11	8011.0D0	thru		808	
dmi	istrip	12	8091.0D0	thru		816	
dmi	istrip	13	8171.0D0	thru		824	
dmi	istrip	14	8251.0D0	thru		832	
dmi	istrip	15	8331.0D0	thru		840	
dmi	istrip	16	8411.0D0	thru		848	
dmi	istrip	17	8491.0D0	thru		856	
\$left outer wing, out to in							
dmi	istrip	18	8571.0D0	thru		864	
dmi	istrip	19	8651.0D0	thru		872	

dmi	istrip	20	8731.0D0	thru	880	
dmi	istrip	21	8811.0D0	thru	888	
dmi	istrip	22	8891.0D0	thru	896	
dmi	istrip	23	8971.0D0	thru	904	
dmi	istrip	24	9051.0D0	thru	912	
dmi	istrip	25	9131.0D0	thru	920	
dmi	istrip	26	9211.0D0	thru	928	
dmi	istrip	27	9291.0D0	thru	936	
dmi	istrip	28	9371.0D0	thru	944	
dmi	istrip	29	9451.0D0	thru	952	
dmi	istrip	30	9531.0D0	thru	960	
dmi	istrip	31	9611.0D0	thru	968	
dmi	istrip	32	9691.0D0	thru	976	
dmi	istrip	33	9771.0D0	thru	984	
dmi	istrip	34	9851.0D0	thru	992	
dmi	istrip	35	9931.0D0	thru	1000	
dmi	istrip	36	10011.0D0	thru	1008	
dmi	istrip	37	10091.0D0	thru	1016	
dmi	istrip	38	10171.0D0	thru	1024	
dmi	istrip	39	10251.0D0	thru	1032	
dmi	istrip	40	10331.0D0	thru	1040	
\$left htail						
dmi	istrip	41	10411.0D0	thru	1048	12011.0D0
dmi	istrip	42	10491.0D0	thru	1056	12031.0D0
dmi	istrip	43	10571.0D0	thru	1064	12051.0D0
dmi	istrip	44	10651.0D0	thru	1072	12071.0D0
dmi	istrip	45	10731.0D0	thru	1080	12091.0D0
dmi	istrip	46	10811.0D0	thru	1088	12111.0D0
dmi	istrip	47	10891.0D0	thru	1096	12131.0D0
dmi	istrip	48	10971.0D0	thru	1104	12151.0D0
dmi	istrip	49	11051.0D0	thru	1112	12171.0D0
dmi	istrip	50	11131.0D0	thru	1120	12191.0D0
dmi	istrip	51	11211.0D0	thru	1128	12211.0D0
dmi	istrip	52	11291.0D0	thru	1136	12231.0D0
dmi	istrip	53	11371.0D0	thru	1144	12251.0D0
dmi	istrip	54	11451.0D0	thru	1152	12271.0D0
dmi	istrip	55	11531.0D0	thru	1160	12291.0D0
dmi	istrip	56	11611.0D0	thru	1168	12311.0D0
dmi	istrip	57	11691.0D0	thru	1176	12331.0D0
dmi	istrip	58	11771.0D0	thru	1184	12351.0D0
dmi	istrip	59	11851.0D0	thru	1192	12371.0D0
dmi	istrip	60	11931.0D0	thru	1200	12391.0D0
\$left vtail						

dmi	istrip	61	12411.0D0	thru	1248	14011.0D0
	1.0D0					
dmi	istrip	62	12491.0D0	thru	1256	14031.0D0
	1.0D0					
dmi	istrip	63	12571.0D0	thru	1264	14051.0D0
	1.0D0					
dmi	istrip	64	12651.0D0	thru	1272	14071.0D0
	1.0D0					
dmi	istrip	65	12731.0D0	thru	1280	14091.0D0
	1.0D0					
dmi	istrip	66	12811.0D0	thru	1288	14111.0D0
	1.0D0					
dmi	istrip	67	12891.0D0	thru	1296	14131.0D0
	1.0D0					
dmi	istrip	68	12971.0D0	thru	1304	14151.0D0
	1.0D0					
dmi	istrip	69	13051.0D0	thru	1312	14171.0D0
	1.0D0					
dmi	istrip	70	13131.0D0	thru	1320	14191.0D0
	1.0D0					
dmi	istrip	71	13211.0D0	thru	1328	14211.0D0
	1.0D0					
dmi	istrip	72	13291.0D0	thru	1336	14231.0D0
	1.0D0					
dmi	istrip	73	13371.0D0	thru	1344	14251.0D0
	1.0D0					
dmi	istrip	74	13451.0D0	thru	1352	14271.0D0
	1.0D0					
dmi	istrip	75	13531.0D0	thru	1360	14291.0D0
	1.0D0					
dmi	istrip	76	13611.0D0	thru	1368	14311.0D0
	1.0D0					
dmi	istrip	77	13691.0D0	thru	1376	14331.0D0
	1.0D0					
dmi	istrip	78	13771.0D0	thru	1384	14351.0D0
	1.0D0					
dmi	istrip	79	13851.0D0	thru	1392	14371.0D0
	1.0D0					
dmi	istrip	80	13931.0D0	thru	1400	14391.0D0
	1.0D0					

• Program strip1440_right

\$dmi	istrip	0	2	2	2	M rows	N cols
dmi	istrip	0	2	2	2	1440	80
\$rt	inner wing						
\$dmi	istrip	col	row	star	1.0D0	thru	row end
dmi	istrip		1		11.0D0	thru	8
dmi	istrip		2		91.0D0	thru	16
dmi	istrip		3		171.0D0	thru	24
dmi	istrip		4		251.0D0	thru	32
dmi	istrip		5		331.0D0	thru	40
dmi	istrip		6		411.0D0	thru	48
dmi	istrip		7		491.0D0	thru	56
dmi	istrip		8		571.0D0	thru	64
dmi	istrip		9		651.0D0	thru	72
dmi	istrip		10		731.0D0	thru	80
dmi	istrip		11		811.0D0	thru	88
dmi	istrip		12		891.0D0	thru	96
dmi	istrip		13		971.0D0	thru	104
dmi	istrip		14		1051.0D0	thru	112
dmi	istrip		15		1131.0D0	thru	120

dmi	istrip	16	1211.0D0	thru	128	
dmi	istrip	17	1291.0D0	thru	136	
\$rt outer wg						
dmi	istrip	18	1371.0D0	thru	144	
dmi	istrip	19	1451.0D0	thru	152	
dmi	istrip	20	1531.0D0	thru	160	
dmi	istrip	21	1611.0D0	thru	168	
dmi	istrip	22	1691.0D0	thru	176	
dmi	istrip	23	1771.0D0	thru	184	
dmi	istrip	24	1851.0D0	thru	192	
dmi	istrip	25	1931.0D0	thru	200	
dmi	istrip	26	2011.0D0	thru	208	
dmi	istrip	27	2091.0D0	thru	216	
dmi	istrip	28	2171.0D0	thru	224	
dmi	istrip	29	2251.0D0	thru	232	
dmi	istrip	30	2331.0D0	thru	240	
dmi	istrip	31	2411.0D0	thru	248	
dmi	istrip	32	2491.0D0	thru	256	
dmi	istrip	33	2571.0D0	thru	264	
dmi	istrip	34	2651.0D0	thru	272	
dmi	istrip	35	2731.0D0	thru	280	
dmi	istrip	36	2811.0D0	thru	288	
dmi	istrip	37	2891.0D0	thru	296	
dmi	istrip	38	2971.0D0	thru	304	
dmi	istrip	39	3051.0D0	thru	312	
dmi	istrip	40	3131.0D0	thru	320	
\$rt htail						
dmi	istrip	41	3211.0D0	thru	328	4811.0D0
	1.0D0					
dmi	istrip	42	3291.0D0	thru	336	4831.0D0
	1.0D0					
dmi	istrip	43	3371.0D0	thru	344	4851.0D0
	1.0D0					
dmi	istrip	44	3451.0D0	thru	352	4871.0D0
	1.0D0					
dmi	istrip	45	3531.0D0	thru	360	4891.0D0
	1.0D0					
dmi	istrip	46	3611.0D0	thru	368	4911.0D0
	1.0D0					
dmi	istrip	47	3691.0D0	thru	376	4931.0D0
	1.0D0					
dmi	istrip	48	3771.0D0	thru	384	4951.0D0
	1.0D0					
dmi	istrip	49	3851.0D0	thru	392	4971.0D0
	1.0D0					
dmi	istrip	50	3931.0D0	thru	400	4991.0D0
	1.0D0					
dmi	istrip	51	4011.0D0	thru	408	5011.0D0
	1.0D0					
dmi	istrip	52	4091.0D0	thru	416	5031.0D0
	1.0D0					
dmi	istrip	53	4171.0D0	thru	424	5051.0D0
	1.0D0					
dmi	istrip	54	4251.0D0	thru	432	5071.0D0
	1.0D0					
dmi	istrip	55	4331.0D0	thru	440	5091.0D0
	1.0D0					
dmi	istrip	56	4411.0D0	thru	448	5111.0D0
	1.0D0					
dmi	istrip	57	4491.0D0	thru	456	5131.0D0
	1.0D0					
dmi	istrip	58	4571.0D0	thru	464	5151.0D0
	1.0D0					

dmi	istrip	59	4651.0D0	thru	472	5171.0D0
	1.0D0					
dmi	istrip	60	4731.0D0	thru	480	5191.0D0
	1.0D0					
\$rt vtail						
dmi	istrip	61	5211.0D0	thru	528	6811.0D0
	1.0D0					
dmi	istrip	62	5291.0D0	thru	536	6831.0D0
	1.0D0					
dmi	istrip	63	5371.0D0	thru	544	6851.0D0
	1.0D0					
dmi	istrip	64	5451.0D0	thru	552	6871.0D0
	1.0D0					
dmi	istrip	65	5531.0D0	thru	560	6891.0D0
	1.0D0					
dmi	istrip	66	5611.0D0	thru	568	6911.0D0
	1.0D0					
dmi	istrip	67	5691.0D0	thru	576	6931.0D0
	1.0D0					
dmi	istrip	68	5771.0D0	thru	584	6951.0D0
	1.0D0					
dmi	istrip	69	5851.0D0	thru	592	6971.0D0
	1.0D0					
dmi	istrip	70	5931.0D0	thru	600	6991.0D0
	1.0D0					
dmi	istrip	71	6011.0D0	thru	608	7011.0D0
	1.0D0					
dmi	istrip	72	6091.0D0	thru	616	7031.0D0
	1.0D0					
dmi	istrip	73	6171.0D0	thru	624	7051.0D0
	1.0D0					
dmi	istrip	74	6251.0D0	thru	632	7071.0D0
	1.0D0					
dmi	istrip	75	6331.0D0	thru	640	7091.0D0
	1.0D0					
dmi	istrip	76	6411.0D0	thru	648	7111.0D0
	1.0D0					
dmi	istrip	77	6491.0D0	thru	656	7131.0D0
	1.0D0					
dmi	istrip	78	6571.0D0	thru	664	7151.0D0
	1.0D0					
dmi	istrip	79	6651.0D0	thru	672	7171.0D0
	1.0D0					
dmi	istrip	80	6731.0D0	thru	680	7191.0D0

APPENDIX E

MATLAB programs used in the frequency response analysis of the two-dimensional gust analysis of the Alliance airplane

- Program `calc_response.m`

```
function [freq,auto,psd,rms,no] = calc_response
%[FREQUENCY APS CPS,RMS,NO] = CALC_RESPONSE
% Calculates the power spectral density matrix. each column of the matrix is the % PSD
of one response quantity as a function of frequency. Case information data % should be
changed in the file 'case_info.data'
%
% See also READ_F06, READ_PCH, CASE_INFO.DATA

% read case information from file "case_info.data"

fid = fopen('case_info.data');
num_strips = fscanf(fid,'%s %s %s %f',1);
num_frequencies = fscanf(fid,'%s %s %s %f',1);
num_responses = fscanf(fid,'%s %s %s %f',1);
sigmaw = fscanf(fid,'%s %s %s %s %f',1);
V = fscanf(fid,'%s %s %f',1);
L = fscanf(fid,'%s %s %s %f',1);
f06_fname = fscanf(fid,'%s %s %s %s %s',1);
pch_fname = fscanf(fid,'%s %s %s %s %s',1);
sep_fname = fscanf(fid,'%s %s %s %s %s',1);

fclose(fid);
save case_info num_strips num_frequencies num_responses sigmaw V L f06_fname
pch_fname sep_fname
case_info = load ('case_info.mat')

if strcmp(pch_fname,'none');
    [freq frf] = read_f06(f06_fname,num_strips,num_responses,num_frequencies); %read f06
data
else
    [freq frf] = read_pch(pch_fname,num_strips,num_responses,num_frequencies); %read
punch file data
end

%save 'frfdata' freq frf;
%load frfdata
omega = 2*pi*freq;

% read the coordinates of the centers of the strips

fid = fopen(sep_fname);
y = fscanf(fid,'%s %s %d %f')';
fclose(fid);
%y=1e-9*y;
% calculate the separation distance between the ith and jth strips

for istrip = 1:num_strips
    s(istrip,:) = abs(y(istrip) - y);
end

% For each frequency calculate the PSD of the responses

for ifreq = 1:num_frequencies
    phi = gust_cross_spectra(omega(ifreq),L,V,s,sigmaw);
    frfi = squeeze(frf(ifreq,:,:));
    psd(ifreq,:,:)= frfi'*phi*frfi;
```

```

end
for iresp = 1:num_responses
    auto(:,iresp) = real(psd(:,iresp,iresp));
end
[rms no] = calc_statistics(freq,auto);

```

• Program calc_statistics.m

```

function [rms,no] = calc_statistics(freq,auto)
% [RMS No] = CALC_STATISTICS(FREQ,AUTO)
% Calculates the root mean square value (RMS) and the zero crossing rate (No)
% of the variables in that have the auto power spectral densities AUTO. Auto is
% arranged in column format (each aps in one column with the elements corresponding
% to the frequencies in FREQ).

% Caculate the rms values
% Generate tow matrices one for aps(j,i) and the other for aps(j,i+1) to take
advantage
% of the vectorization capabilities of Matlab

[n_frequencies n_vars] = size(auto);
autoi = auto(1:n_frequencies-1,:);
autoip1 = auto(2:n_frequencies,:);
freqmat = repmat(freq,1,n_vars);
freqi = freqmat(1:n_frequencies-1,:);
freqip1 = freqmat(2:n_frequencies,:);
ms = 0.5 * sum((autoi+autoip1).*(freqip1-freqi)),1);
rms = sqrt(ms);
alpha = 3*freqi.^2 + 2*freqi.*freqip1 + freqip1.^2;
beta = freqi.^2 + 2*freqi.*freqip1 + 3*freqip1.^2;
r = sqrt(sum((alpha.*autoi+beta.*autoip1).*(freqip1-freqi)),1)/12);
no = r./rms;

```

• Program gust_cross-spectra.m

```

function phil2 = gust_cross_spectra(omega,L,V,s,sigmax)
% PHIL2 = GUST_CROSS_SPECTRA(OMEGA,L,V,S,SIGMAW)
% CALCULATES THE TWO DIMENSIONAL GUST LOAD CROSS SPECTRA BETWEEN TWO
% STRIPS A WITH A SEPARATION DISTANCE S. OMEGA IS THE FREQUENCY, V IS THE VELOCITY,
% L IS THE GUST SCALE OF TURBULANCE, AND SIGMAW IS THE RMS VALUE OF THE GUST VELOCITY.
sigma = s/L;
r = sigma==0;
sigma = sigma+r;
nu = omega * L / V;
z = sigma .* sqrt(1 + ( 1.339 .* nu ) .^ 2 ) / 1.339;
phil2 = sqrt(2*pi)*sigmax^2 * 2^(2/3) * L/( V * gamma(1/3) * (1.339) ^ (8/3) ) ...
    * (8*1.339^2 * sigma .^ (5/3) .* bessellk((5/6),z) ./ (3 * z .^ (5/6) ) ...
    - sigma .^ (11/3) .* bessellk((11/6),z) ./ z .^ (11/6) );
phiii = 2 *sigmax^2 * L/V * ( 1 + 8/3 * ( 1.339 * nu ) .^ 2 ) ...
    ./ ( 1 + (1.339 * nu ) .^ 2 ) .^ (11/6);
phil2 = phil2 - r.* phil2 + r * phiii;

```

• Program read_pch.m

```

function [frequency,frf] = read_pch(fname,num_strips,num_responses,num_frequencies)
% [FREQUENCY RESP] = READ_PCH(PCH FILE NAME, NUMBER OF STRIPS, NUMBER OF RESPONCES,
NUMBER OF FREQUENCIES)
% Reads the data in the punch file and stores it into a 3-d array with the following
index order
% (frequency index,strip number index, response index)

fp = fopen(fname);

```

```

% Loop over the strips
for istrip = 1:num_strips

    % Loop over the responses
    for iresponse = 1:num_responses

        % skip header line that which is not needed

        line = fscanf(fp, '%*s %*s %*d %*d %*d %d',1);

        % read the real part of the response

        data = fscanf(fp, '%f %f', [4 num_frequencies]);
        data1 = data(3,:);

        % Skip header line which is not needed

        line = fscanf(fp, '%*s %*s %d %d %d %d',[1 4]);

        % read the imaginary part of the data

        data = fscanf(fp, '%f %f', [4 num_frequencies]);

        % Arrange the data in a 3-d array (frequency index, strip number index, response
        index)

        frf(:,istrip,iresponse) = data1 + i*data(3,:);

    % Close looping over the response
    end

% Close looping over the strip number
end

%close the data file
fclose(fp);

% Write the frequency vector

frequency = data(2,:);

```

• Program read_f06.m

```

function [frequency,frf] = read_f06(fname,num_strips,num_responses,num_frequencies)
% RESP = READ_F06(F06 FILE NAME, NUMBER OF STRIPS, NUMBER OF RESPONCES, NUMBER OF
FREQUENCIES)
% Reads the data in the f06 file and stores it into a 3-d array with the following
index order
% (frequency index,strip number index, response index)

fp = fopen(fname);

line=zeros(1,40);
x = char(line(29:40));
y = 'PRINT NUMBER';

% Loop over the strips
for istrip = 1:num_strips

    % Loop over the responses

```

```

for iresponse = 1:num_responses

    % skip text lines that which not needed

    line=zeros(1,40);
    x = char(line(29:40));
    while ~ strcmp(x,y);
        line = fgetl(fp);
        if length(line) < 40 ; line = zeros(1,40);end
        x = char(line(29:40));
    end

    % read the magnitude of the response

    data = fscanf(fp, '%f %f', [3 num_frequencies]);
    data1 = data(3,:);

    % Skip text lines which are not needed

    line=zeros(1,40);
    x = char(line(29:40));
    while ~ strcmp(x,y);
        line = fgetl(fp);
        if length(line) < 40 ; line = zeros(1,40);end
        x = char(line(29:40));
    end

    % read the phase of the data

    data = fscanf(fp, '%f %f', [3 num_frequencies]);

    % Arrange the data in a 3-d array (frequency index, strip number index, response
    index)

    frf(:,istrip,iresponse) = data1 + i*data(3,:);

    % Close looping over the response
end

% Close looping over the strip number
end

%close the data file
fclose(fp);

% Write the frequency vector

frequency = data(2,:);

```

- **Program case_info.data**

number of strips	160
number of frequencies	201
number of responses	40
rms of gust velocity	1
forward velocity	1179.6
gust scale length	12000
nastran f06 file name	none
nastran pch file name	
/home0/naser/Nastran_results/1440noskip/k_10/gustv5_span.pch	
strip coordinate file name	yspan160_0

• **Program yspan160**

Box no.	1	6.57353
Box no.	9	19.7206
Box no.	17	32.8676
Box no.	25	46.0147
Box no.	33	59.1618
Box no.	41	72.3088
Box no.	49	85.4559
Box no.	57	98.6029
Box no.	65	111.750
Box no.	73	124.897
Box no.	81	138.044
Box no.	89	151.191
Box no.	97	164.338
Box no.	105	177.485
Box no.	113	190.632
Box no.	121	203.779
Box no.	129	216.926
Box no.	137	230.065
Box no.	145	243.196
Box no.	153	256.326
Box no.	161	269.457
Box no.	169	282.587
Box no.	177	295.717
Box no.	185	308.848
Box no.	193	321.978
Box no.	201	335.109
Box no.	209	348.239
Box no.	217	361.370
Box no.	225	374.500
Box no.	233	387.630
Box no.	241	400.761
Box no.	249	413.891
Box no.	257	427.022
Box no.	265	440.152
Box no.	273	453.283
Box no.	281	466.413
Box no.	289	479.543
Box no.	297	492.674
Box no.	305	505.804
Box no.	313	518.935
Box no.	321	527.875
Box no.	329	532.625
Box no.	337	537.375
Box no.	345	542.125
Box no.	353	546.875
Box no.	361	551.625
Box no.	369	556.375
Box no.	377	561.125
Box no.	385	565.875
Box no.	393	570.625
Box no.	401	575.375
Box no.	409	580.125
Box no.	417	584.875
Box no.	425	589.625
Box no.	433	594.375
Box no.	441	599.125
Box no.	449	603.875
Box no.	457	608.625
Box no.	465	613.375
Box no.	473	618.125
Box no.	521	497.225
Box no.	529	498.675

Box no.	537	500.125
Box no.	545	501.575
Box no.	553	503.025
Box no.	561	504.475
Box no.	569	505.925
Box no.	577	507.375
Box no.	585	508.825
Box no.	593	510.275
Box no.	601	511.725
Box no.	609	513.175
Box no.	617	514.625
Box no.	625	516.075
Box no.	633	517.525
Box no.	641	518.975
Box no.	649	520.425
Box no.	657	521.875
Box no.	665	523.325
Box no.	673	524.775
Box no.	721	-216.926
Box no.	729	-203.779
Box no.	737	-190.632
Box no.	745	-177.485
Box no.	753	-164.338
Box no.	761	-151.191
Box no.	769	-138.044
Box no.	777	-124.897
Box no.	785	-111.750
Box no.	793	-98.6029
Box no.	801	-85.4559
Box no.	809	-72.3088
Box no.	817	-59.1618
Box no.	825	-46.0147
Box no.	833	-32.8676
Box no.	841	-19.7206
Box no.	849	-6.57353
Box no.	857	-518.935
Box no.	865	-505.804
Box no.	873	-492.674
Box no.	881	-479.543
Box no.	889	-466.413
Box no.	897	-453.283
Box no.	905	-440.152
Box no.	913	-427.022
Box no.	921	-413.891
Box no.	929	-400.761
Box no.	937	-387.630
Box no.	945	-374.500
Box no.	953	-361.370
Box no.	961	-348.239
Box no.	969	-335.109
Box no.	977	-321.978
Box no.	985	-308.848
Box no.	993	-295.717
Box no.	1001	-282.587
Box no.	1009	-269.457
Box no.	1017	-256.326
Box no.	1025	-243.196
Box no.	1033	-230.065
Box no.	1041	-618.125
Box no.	1049	-613.375
Box no.	1057	-608.625
Box no.	1065	-603.875
Box no.	1073	-599.125

Box no.	1081	-594.375
Box no.	1089	-589.625
Box no.	1097	-584.875
Box no.	1105	-580.125
Box no.	1113	-575.375
Box no.	1121	-570.625
Box no.	1129	-565.875
Box no.	1137	-561.125
Box no.	1145	-556.375
Box no.	1153	-551.625
Box no.	1161	-546.875
Box no.	1169	-542.125
Box no.	1177	-537.375
Box no.	1185	-532.625
Box no.	1193	-527.875
Box no.	1241	-524.775
Box no.	1249	-523.325
Box no.	1257	-521.875
Box no.	1265	-520.425
Box no.	1273	-518.975
Box no.	1281	-517.525
Box no.	1289	-516.075
Box no.	1297	-514.625
Box no.	1305	-513.175
Box no.	1313	-511.725
Box no.	1321	-510.275
Box no.	1329	-508.825
Box no.	1337	-507.375
Box no.	1345	-505.925
Box no.	1353	-504.475
Box no.	1361	-503.025
Box no.	1369	-501.575
Box no.	1377	-500.125
Box no.	1385	-498.675
Box no.	1393	-497.225

APPENDIX F

MSC/NASTRAN files used in the frequency response analysis of the BAH wing under two-dimensional gust loads

- **Program ha146c_full2.dat**

```

$ DEC/CMS REPLACEMENT HISTORY, Element HA146C.DAT
$ *2      6-JUL-1994 14:13:13 A_BOYADJIAN "68 PLUS/G/ CHANGE DBSDIR: TO TPLDIR: FOR
INCLUDE CARDS"
$ *1      5-JUL-1994 17:05:32 A_BOYADJIAN "68 PLUS/G/ NEW FOR V68 AERO_SS BOOK"
$ DEC/CMS REPLACEMENT HISTORY, Element HA146C.DAT
ID MSC, HA146C $ E_JOHNSON V68  5-JUL-1994
$ID MSC,HA146C
$$$$$$$$$          HANDBOOK FOR AEROELASTIC ANALYSIS EXAMPLE          $$$$$$$$$$
$
$      MODEL DESCRIPTION          BAH JET TRANSPORT WING EXAMPLE          $
$                                  USING A STIFF AILERON. RESPONSE          $
$                                  TO TWO DIMENSIONAL RANDOM GUST.          $
$
$      SOLUTION          AEROELASTIC RESPONSE USING THE DOUBLET-LATTICE $
$                          METHOD AERODYNAMICS AT MACH NO. OF 0          $
$                          AND CORRELATION STRIPS WITH A DMAP ALTER          $
$
$      OUTPUT          XY PLOTS OF GRID POINT LOADS AND          $
$                          ACCELERATIONS          $
$
$$$$$$$$$          $$$$$$$$$$
TIME 30      $ CPU TIME IN MINUTES
SOL 146      $ DYNAMIC AEROELASTIC RESPONSE
include 'alterv4.dat'
CEND
LINE = 99999
TITLE = BAH JET TRANSPORT WING DYNAMIC ANALYSIS HA146C
LABEL = RESPONSE TO TWO DIMENSIONAL GUST
ECHO = NONE
METHOD = 1          $ SINV EIGENVALUE EXTRACTION METHOD
SDAMP = 2000          $ STRUCTURAL DAMPING (2 PERCENT SPECIFIED)
FREQUENCY = 40          $ FREQUENCY LIST
RANDOM = 1031          $ PSD SPECIFICATION (RANDPS)
K2PP = STIFF          $ DMIG STIFFNESS
OUTPUT
SET 1 = 11
SUBCASE 1
PARAM, NSTRIprm, 11
LABEL = RANDOM GUST ANALYSIS
GUST = 1005          $ APPLY THE RANDOM GUST
OUTPUT(XYOUT)          $ FREQ RESP PACKAGE (COMPLEX NUMBERS)
$$$$$$$$$$$$$$$$$$$$
XYPRINT, XYPUNCH ELFORCE RESPONSE / 802(5,12)
XYPRINT, XYPUNCH ELFORCE RESPONSE / 803(5,12)
XYPRINT, XYPUNCH ACCE RESPONSE / 11(T3RM, T3IP)
XYPRINT, XYPUNCH ACCE RESPONSE / 10(T3RM, T3IP)
$
BEGIN BULK
SUPT 11      345
include 'BAH_strip'
$
INCLUDE 'bahstru_full2.dat'
$
$
$      TABDMPI DEFINES DAMPING COEFFICIENTS (G1) VERSES FREQUENCY (F1).
$      (3 PERCENT STRUCTURAL DAMPING IS SPECIFIED OVER THE ENTIRE FREQUENCY

```

```

$      RANGE. VALUES ARE LINEARLY INTERPOLATED AND EXTRAPOLATED. A 2%
$      STRUCTURAL DAMPING IS ROUGHLY EQUIVALENT TO 1.5% CRITICAL DAMPING.)
$
$      ID      TYPE
TABDMP1 2000      G
+TABDMP 0.      .02      10.      .02      ENDT
$
$ * * * * *
$
$      * * DYNAMIC LOAD AND RESPONSE DATA * *
$
$      GUST DEFINES A STATIONARY VERTICAL GUST. LISTED ARE T/RLOAD ENTRY
$      ID, RATIO OF GUST VEL/VEHICLE VEL, LOCATION OF THE GUST WITH RESPECT
$      TO THE ORIGIN OF THE AERO COORDINATE SYSTEM AND VEHICLE VELOCITY.
$
$      SID      DLOAD      WG      X0      V
GUST 1005      3002      .001435 0.      8360.
$
$      RLOAD1 DEFINES A FREQUENCY DEPENDENT DYNAMIC LOAD. LISTED ARE
$      THE ID, DAREA ID, DELAY ID, DPHASE ID AND TABLED1 ENTRIES.
$
$      SID      L      M      N      TC      TD
RLOAD1 3002      3003
$
$      DAREA DEFINES THE DOF WHERE THE LOAD IS APPLIED AND A SCALE FACTOR.
$
$      SID      P      C      A
DAREA 3003      11
$
$      TABLED1 DEFINES A TABULAR FUNCTION OF A FREQUENCY-DEPENDENT LOAD.
$
$      SID
TABLED1 3004
$      X1      Y1      X2      Y2      ETC.
+T1004 0.      0.      0.001 1.0      10.0 1.0      ENDT
$
$      RANDPS DEFINES POWER SPECTRAL DENISITY FACTORS FOR RANDOM
$      ANALYSIS. LISTED ARE EXCITED AND APPLIED LOAD SET IDS AND
$      THEIR SCALE FACTORS.
$
$      SID      J      K      X      Y      TID
RANDPS 1031      1      1      1.0 0.      1032
$
$      VON KARMAN GUST WITH (L/U)=0.7180 SEC., AND WG=1.0 IN/SEC
TABRNDG 1032      1      0.7180 1.0
$ * * * * *
$
$      * * * AERODYNAMIC DATA * * *
$
$      (THIS MODEL USES THE LB-IN-SEC SYSTEM)
$
$      * * ELEMENT GEOMETRY * *
$
$      THE AERO ENTRY DEFINES BASIC AERODYNAMIC PARAMETERS. ACSID IS THE
$      AERO COORDINATE SYSTEM. VELOCITY. REFC IS THE REFERENECE
$      COORDINATE SYSTEM. RHOREF IS REFERENCE DENSITY. SYMXZ AND
$      SYMXY ARE SYMMETRY KEYS.
$
$      ACSID      VELOCITY REFC      RHOREF      SYMXZ      SYMXY
AERO 0      8360.      131.232 1.1468-70      0
$
$      INCLUDE 'bahaero_full12.dat'
$

```

```

$      THE MKAERO1 ENTRY DEFINES COMBINATIONS OF MACH NUMBER AND REDUCED
$      FREQUENCY EACH OF WHICH WILL BE USED TO GENERATE A MATRIX OF
$      GENERALIZED AERODYNAMIC FORCES.
$
$      M1      M2      M3      M4      ETC
MKAERO1 .62
$      K1      K2      K3      K4      ETC
+MK      0.001  0.05   0.10   0.20   0.50   1.0   2.0
$
$      PARAM,GUSTAERO,-1 IS REQUIRED IF GUST LOADS ARE TO BE COMPUTED.
$
PARAM    GUSTAERO -1
$
$      PARAM,M SPECIFIES MACH NUMBER.
$
PARAM    M      0.62
$
$      PARAM,Q SPECIFIES DYNAMIC PRESSURE.
$
PARAM    Q      4.00747
$      PARAM LMOD SPECIFIES THE NUMBER OF MODES TO BE INCLUDED
$
PARAM, LMODES, 10 $INCLUDE THE FIRST 10 MODES
$
PARAM, DDRMM, -1
$ * * * * *
$
$      * * VIBRATION AND FREQUENCY RESPONSE DATA * *
$
$      EIGR DEFINES EIGENVALUE EXTRACTION DATA. LISTED ARE THE
$      EIGENVALUE EXTRACTION METHOD, FREQUENCY RANGE, NUMBER OF
$      EXPECTED AND DESIRED ROOTS AND THE METHOD OF NORMALIZATION.
$
$      SID      METHOD  F1      F2      NE      ND
EIGR      1      SINV   0.0    25.0    30
$
$      FREQ AND FREQ1 DEFINE THE SET OF FREQUENCIES USED TO OBTAIN
$      THE FREQUENCY RESPONSE SOLUTION. FREQ LISTS ARBITRARILY
$      SPACED FREQUENCIES. FREQ1 PROVIDES EQUALLY SPACED FREQUENCIES
$      BY SPECIFYING THE STARTING FREQUENCY, THE FREQUENCY INCREMENT
$      AND NUMBER OF INCREMENTS.
$
$      SID      F1      DF      NDF
FREQ1     40      0.05   0.05   350
$
$ * * * * *
$
$      THE EPOINT ENTRY DEFINES AN "EXTRA" POINT IN THE MODEL.
$
EPOINT    50
$
$      DISJOINT DOF ADDED TO THE STRUCTURAL STIFFNESS MATRIX
$      WHICH IS USED TO CHECK THE INPUT GUST PSD.
$
$      NAME      "0"      IFO      TIN      TOUT      POLAR      NCOL
DMIG      STIFF    0        6        1        0
DMIG      STIFF    50       0        50       0        1.
$
$ * * * * *
ENDDATA

```

• Program bahstru_full2.dat

```

$***$
$
$          * * * STRUCTURAL DATA * * *
$
$          (LB-IN-SEC SYSTEM)
$
$          * * GRID GEOMETRY * *
$
$
$ RIGHT HAND SIDE
$      ID      CP      X1      X2      X3      CD      PS      SEID
GRID    1      -20.25  90.      12456
GRID    2      81.      90.      12456
GRID    3      -17.85  186.     12456
GRID    4      71.4    186.     12456
GRID    5      -15.8   268.     12456
GRID    6      63.2    268.     12456
GRID    7      -13.3   368.     12456
GRID    8      53.2    368.     12456
GRID    9      -11.05  458.     12456
GRID   10      44.2    458.     12456
GRID   11      0.0     0.      126
GRID   12      0.0     45.     126
$
$ LEFT HAND SIDE
GRID   91      -20.25 -90.      12456
GRID   92      81.     -90.      12456
GRID   93      -17.85 -186.     12456
GRID   94      71.4    -186.     12456
GRID   95      -15.8   -268.     12456
GRID   96      63.2    -268.     12456
GRID   97      -13.3   -368.     12456
GRID   98      53.2    -368.     12456
GRID   99      -11.05 -458.     12456
GRID  910      44.2    -458.     12456
GRID  911      0.0     0.      126
GRID  912      0.0    -45.     126
$
$          * * STRUCTURAL STIFFNESS PROPERTIES * *
$
$          * FLEXIBILITY INFLUENCE COEFFICIENTS *
$
$ THE GENEL ENTRY DEFINES A GENERAL ELEMENT IN TERMS OF ITS
$ STRUCTURAL INFLUENCE COEFFICIENTS. IT LISTS THE ELEMENT
$ ID NO. AND PAIRS OF GRID POINT NUMBERS PLUS THEIR UNCON-
$ STRAINED DOFS. THIS IS FOLLOWED BY THE CORRESPONDING PAIRS
$ THAT WERE CONSTRAINED TO OBTAIN THE INFLUENCE COEFFICIENTS.
$ THIS IS FOLLOWED BY THE LOWER TRIANGULAR PART OF THE MATRIX
$ OF INFLUENCE COEFFICIENTS. FINALLY, A MATRIX OF GEOMETRIC
$ CONSTANTS IS LISTED. THESE CONSTANTS PRODUCE TOTAL FORCES
$ AND MOMENTS DUE TO DEFLECTIONS IN EACH MODE, IN THIS CASE
$ LIFT, ROLLING MOMENT, PITCHING MOMENT AND WING ROOT BENDING
$ MOMENT.
$
$ RIGHT HAND SIDE
$      EID      UI1      CI1      UI2      CI2      UI3      CI3
GENEL  432      1        3        2        3        3        3      +01
+01    4        3        5        3        6        3        7      +02
+02    8        3        9        3       10        3      +03
$      "UD"      UD1      CD1      UD2      CD2      UD3      CD3
+03    UD      11        3       11        4       11        5      +04
$      "K"|"Z"  Z11      Z21      Z31      ETC      (BY COLUMNS)

```


CMASS2	113	0.005	11	3
CMASS2	114	0.005	11	4
CMASS2	115	0.005	11	5

\$ \$

\$ LEFT HAND SIDE

\$

\$

\$	EID	M	G1	C1	G2	C2
CMASS2	9101	5248.7	91	3		
CMASS2	9102	134.9	91	3	92	3
CMASS2	9103	790.3	92	3		
CMASS2	9201	9727.	93	3		
CMASS2	9202	11005.	93	3	94	3
CMASS2	9203	473.	94	3		
CMASS2	9301	3253.6	95	3		
CMASS2	9302	-139.7	95	3	96	3
CMASS2	9303	946.3	96	3		
CMASS2	9401	2617.8	97	3		
CMASS2	9402	21.	97	3	98	3
CMASS2	9403	782.3	98	3		
CMASS2	9501	494.8	99	3		
CMASS2	9502	-7.3	99	3	910	3
CMASS2	9503	185.2	910	3		
CMASS2	9113	0.005	911	3		
CMASS2	9114	0.005	911	4		
CMASS2	9115	0.005	911	5		

\$ * FUSELAGE MASS AND INERTIA VALUES * \$

\$ \$

\$ THE CONM1 ENTRY DEFINES A 6 BY 6 SYMMETRIC INERTIA MATRIX \$

\$ FOR A GRID POINT. LISTED IS THE ID, THE GRID POINT NO., \$

\$ THE COORDINATE SYSTEM IN WHICH THE INERTIA MATRIX IS \$

\$ DEFINED AND THE LOWER LEFT TRIANGULAR PART OF THE MATRIX. \$

\$

\$ RIGHT HAND SIDE

\$

\$	EID	G	CID	M11	M21	M22	M31	M32	
CONM1	1	12							+51
\$	M33	M41	M42	M43	M44	M51	M52	M53	
+51	17400.				8.47+6				+52
\$	M54	M55	M61	M62	M63	M64	M65	M66	
+52		4.35+09							

\$ \$

\$ LEFT HAND SIDE

\$	EID	G	CID	M11	M21	M22	M31	M32	
CONM1	2	912							+53
\$	M33	M41	M42	M43	M44	M51	M52	M53	
+53	17400.				8.47+6				+54
\$	M54	M55	M61	M62	M63	M64	M65	M66	
+54		4.35+09							

\$ * * STRUCTURAL PARAMETERS * * \$

\$ \$

\$ THE PARAM,WTMASS,GINV CAUSES ALL THE STRUCTURAL MASSES AND \$

\$ MASS DENSITIES TO BE MULTIPLIED BY GINV (I.E., BY ONE OVER \$

\$ THE ACCELERATION OF GRAVITY). THE DYNAMIC PRESSURE SUPPLIED \$

\$ FOR AERODYNAMIC FORCE CALCULATIONS WILL NOT BE MULTIPLIED \$

\$ BY GINV. \$

\$ \$

PARAM WTMASS .0025907

\$ \$

\$ THE PARAM,GRDPNT,XX ENTRY CAUSES THE GRID POINT WEIGHT \$

\$ GENERATOR TO BE EXECUTED USING GRID POINT XX AS THE REF- \$

\$ ERENCE POINT. THEN THE INERTIA MATRIX, THE TRANSFER MATRIX \$
 \$ FROM BASIC TO PRINCIPAL AXES AND OTHER PERTINENT INERTIA \$
 \$ DATA ARE PRINTED. \$
 \$ \$ \$

PARAM GRDPNT 11 \$

\$CBARS AMD MAT1S

\$CBAR	45	10	11	12	-1.0	0.0	0.0
\$CBAR	945	10	11	912	1.0	0.0	0.0
\$PBAR	10	10	1.0		1.0	1.0	
\$2345678\$2345678\$2345678\$2345678\$2345678\$2345678\$2345678\$2345678							
pbeam	10	10	1.0	1.0	1.0		1.0
pbeam	11	11	1.0	1.0	1.0		1.0
cbeam	801	11	912	12	-1.0	0.0	0.0
cbeam	802	10	11	12	-1.0	0.0	0.0
cbeam	803	10	911	912	1.0	0.0	0.0
MAT1	10	1.+14		0.33			
MAT1	11	1.+20		0.33			
\$RBE2	801	12	345	912			

• bahaero_full2.dat

\$ THIS CORD2R ENTRY DEFINES THE AERO COORDINATE SYSTEM \$
 \$ FLAGGED BY THE AERO ENTRY. LISTED ARE THE ORIGIN, A \$
 \$ POINT ALONG THE Z AXIS AND A POINT IN THE X-Z PLANE, \$
 \$ ALL IN THE RID COORDINATE SYSTEM. NOTE THAT IN THIS \$
 \$ COORDINATE SYSTEM THE UPSIDE DOWN AND BACKWARDS STRUC- \$
 \$ TURE WILL FLY UPSIDE UP AND FORWARD. \$
 \$ \$ \$

	CID	RID	A1	A2	A3	B1	B2	B3	
\$CORD2R	1		0.	0.	0.	0.	0.	-1.	+C1
\$	C1	C2	C3						
+\$C1	-1.	0.	0.						

\$ THE CAERO1 ENTRY IS USED FOR DOUBLET-LATTICE AERODYNAMICS. \$
 \$ LISTED ARE ITS PAERO ENTRY ID AND THE COORDINATE SYSTEM \$
 \$ FOR LOCATING THE INBOARD AND OUTBOARD LEADING EDGE POINTS \$
 \$ (1 AND 4). NSPAN AND NCHORD, OR LSPAN AND LCHORD, ARE \$
 \$ USED TO PARTITION THE WING INTO AERODYNAMIC BOXES, THE \$
 \$ FORMER FOR UNIFORMLY SPACED BOXES AND THE LATTER FOR \$
 \$ NON-UNIFORMLY SPACED BOXES. IGID IS THE ID OF ITS \$
 \$ ASSOCIATED INTERFERENCE GROUP. THE CONTINUATION ENTRY \$
 \$ DEFINES POINTS 1 AND 2, THE ROOT CHORD AND THE TIP CHORD. \$
 \$ THE BOXES FORMED BY THE GRID LINES WILL BE NUMBERED \$
 \$ BEGINNING WITH EID, SO A NUMBER SHOULD BE CHOSEN THAT IS \$
 \$ UNIQUE, AND IS GREATER THAN ALL STRUCTURAL GRID, SCALAR \$
 \$ AND EXTRA POINT IDS. \$

\$ RHS

	EID	PID	CP	NSPAN	NCHORD	LSPAN	LCHORD	IGID	\$
CAERO1	1001	1000	0		5	77		1	+CA
\$	(FWD INBOARD POINT)			ROOTCHORD	(FWD OUTBOARD POINT)	TIP CHORD			+CA1
+CA1	-78.75	0.0	0.0	225.0	-35.0	500.0	0.0	100.0	

\$ LHS

	EID	PID	CP	NSPAN	NCHORD	LSPAN	LCHORD	IGID	\$
CAERO1	2001	1000	0		5	77		1	+CA2
+CA2	-78.75	0.0	0.0	225.0	-35.0	-500.0	0.0	100.0	

\$ THE AEFACT ENTRY IS A UTILITY ENTRY USED TO SPECIFY LISTS OF \$
 \$ NUMBERS. THE CAERO1 ENTRY IDENTIFIES THEM BY LSPAN AND LCHORD.\$
 \$ THIS AEFACT ENTRY AND ITS CONTINUATION CARD CONTAIN SIX FIELDS \$

```

$          WHICH SPECIFY THE STRIP EDGES AS FRACTIONS OF THE SPAN.          $
$                                                                              $
$          SID      D1      D2      D3      ETC          $
AEFACT 77      .0      .09      .276      .454      .636      .826      1.0
$                                                                              $
$          THE PAERO ENTRY IS REQUIRED EVEN THOUGH IT IT NON-FUNCTIONAL      $
$          (BECAUSE THERE ARE NO ASSOCIATED BODIES IN THIS EXAMPLE).        $
$                                                                              $
PAERO1 1000
$          * * SPLINE FIT ON THE LIFTING SURFACES * *                      $
$                                                                              $
$          * LINEAR SPLINE FIT ON THE WING *                                $
$                                                                              $
$          THE SPLINE2 ENTRY SPECIFIES A BEAM SPLINE FOR INTERPOLAT-        $
$          ION OVER THE REGION OF THE CAERO ENTRY (ID1 AND ID2 ARE          $
$          THE FIRST AND LAST BOXES IN THIS REGION). SETG REFERS           $
$          TO A SET1 ENTRY WHERE THE STRUCTURAL GRID POINTS ARE            $
$          DEFINED. DZ AND DTOR ARE SMOOTHING CONSTANTS FOR LINEAR          $
$          ATTACHMENT AND TORSIONAL FLEXIBILITIES. DTHX AND DTHY           $
$          ARE ROTATIONAL ATTACHMENT FLEXIBILITIES. CID IDENTIFIES          $
$          THE SPLINE AXIS.                                                  $
$                                                                              $
$          EID      CAERO  ID1      ID2      SETG      DZ      DTOR      CID    $
SPLINE2 100      1001  1001      1030      14      0.0      1.0      0      +SP100
$          DTHX      DTHY
+SP100 -1.0      -1.0
$
$          SPLINE2 200      2001  2001      2030      914      0.0      1.0      0      +SP200
+SP200 -1.0      -1.0
$
$          THE SET1 ENTRY DEFINES THE SETS OF STRUCTURAL GRID POINTS      $
$          TO BE USED BY THE BEAM SPLINE FOR INTERPOLATION.                $
$                                                                              $
$          SID      G1      G2      G3      G4      G5      G6
SET1 14      1      THRU 11
SET1 914     91      THRU 99      910      911

```

• Program alterv4.dat

```

compile seaero list ref
ALTER 'IF ( EXTRCV=0 ) THEN',''
ALTER 'CALL SESUM '(1,+2),''
ALTER 'IF ( NOT(NOPH2 OR SAVERSTL) ) THEN',''
ALTER 'IF ( FOURIER ) THEN'(1,-3),''(1,-1)
ALTER 'CALL FDRMGEN USET,VGFD'(1,-1),''
$ALTER 'DELETE /QHH,QHJ,QKH,,',''
ALTER 'TYPE PARM,,I,N,KCNT=1,CNTR=0,NOMKLIST=1,NUMI','' $
TYPE PARM,,I,N,KCNT,CNTR,NOMKLIST,NUMI $
TYPE PARM,,I,N,NSKIPPDF $
TYPE PARM,,I,Y,NSTRIPRM $
ALTER 'IF ( OPPHIB>=0 OR OPPHIPA>=0'
ENDIF $ NOEDTS>0
NSKIPPDF=0 $ INITIALIZE
COPY AERO/AEROTEMP/ALWAYS/-1 $
COPY CASES/CASETEMP/ALWAYS/-1 $
DO WHILE (NSKIPPDF<NSTRIPRM ) THEN $
NSKIPPDF=NSKIPPDF+1 $
$ CASE CASECC,/CASE1/'TRAN'/S,N,NSKIPPDF $
$ PVT PVT,CASE1// $
$ PARAML CASE1/'DTI'/1/1//S,N,SUBID $
MESSAGE //' NSKIPPDF='/'NSKIPPDF $
CNTR=0 $ INITIALIZE
KCNT=1 $ INITIALIZE

```


APPENDIX G

MATLAB programs used in the frequency response analysis of the BAH wing under two dimensional gust loads

• Program calc_response.m

```
function [freq,auto,psd,rms,no] = calc_response
%[FREQUENCY APS CPS,RMS,NO] = CALC_RESPONSE
% Calculates the power spectral density matrix. Each column of the matrix is the PSD of
one response
% quantity as a function of frequency. Case information data should be changed in the
file
%
% 'case_info.data'
%
% See also CASE_INFO.DATA

% read case information from file "case_info.data"

fid = fopen('case_info.data');
num_strips = fscanf(fid,'%s %s %s %f',1);
num_frequencies = fscanf(fid,'%s %s %s %f',1);
num_responses = fscanf(fid,'%s %s %s %f',1);
sigmaw = fscanf(fid,'%s %s %s %s %f',1);
V = fscanf(fid,'%s %s %f',1);
L = fscanf(fid,'%s %s %s %f',1);
f06_fname = fscanf(fid,'%s %s %s %s %s %s',1);
pch_fname = fscanf(fid,'%s %s %s %s %s %s',1);
sep_fname = fscanf(fid,'%s %s %s %s %s %s',1);

fclose(fid);
save case_info num_strips num_frequencies num_responses sigmaw V L f06_fname
pch_fname sep_fname
case_info = load ('case_info.mat')

if strcmp(pch_fname,'none');
    [freq frf] = read_f06(f06_fname,num_strips,num_responses,num_frequencies); %read f06
data
else
    [freq frf] = read_pch(pch_fname,num_strips,num_responses,num_frequencies); %read
punch file data
end

%save 'frfdata' freq frf;
%load frfdata
omega = 2*pi*freq;

% read the coordinates of the centers of the strips

fid = fopen(sep_fname);
y = fscanf(fid,'%s %s %d %f')';
fclose(fid);
%y=1e-9*y;
% calculate the separation distance between the ith and jth strips

for istrip = 1:num_strips
    s(istrip,:) = abs(y(istrip) - y);
end

% For each frequency calculate the PSD of the responses

for ifreq = 1:num_frequencies
    phi = gust_cross_spectra(omega(ifreq),L,V,s,sigmaw);
```

```

    frfi = squeeze(frf(ifreq, :, :));
    psd(ifreq, :, :) = frfi'*phi*frfi;
end
for iresp = 1:num_responses
    auto(:, iresp) = real(psd(:, iresp, iresp));
end
[rms no] = calc_statistics(freq, auto);

```

• Program calc_statistics.m

```

function [rms, no] = calc_statistics(freq, auto)
% [RMS No] = CALC_STATISTICS(FREQ, AUTO)
% Calculates the root mean square value (RMS) and the zero crossing rate (No)
% of the variables in that have the auto power spectral densities AUTO. Auto is
% arranged in column format (each aps in one column with the elements corresponding
% to the frequencies in FREQ).
% Caculate the rms values
% Generate tow matrices one for aps(j,i) and the other for aps(j,i+1) to take
advantage
% of the vectorization capabilities of Matlab
[n_frequencies n_vars] = size(auto);
autoi = auto(1:n_frequencies-1, :);
autoip1 = auto(2:n_frequencies, :);
freqmat = repmat(freq, 1, n_vars);
freqi = freqmat(1:n_frequencies-1, :);
freqip1 = freqmat(2:n_frequencies, :);
ms = 0.5 * sum(((autoi+autoip1).*(freqip1-freqi)), 1);
rms = sqrt(ms);
alpha = 3*freqi.^2 + 2*freqi.*freqip1 + freqip1.^2;
beta = freqi.^2 + 2*freqi.*freqip1 + 3*freqip1.^2;
r = sqrt(sum(((alpha.*autoi+beta.*autoip1).*(freqip1-freqi)), 1)/12);
no = r./rms;

```

• Program read_pch.m

```

function [frequency, frf] = read_pch(fname, num_strips, num_responses, num_frequencies)
% [FREQUENCY RESP] = READ_PCH(PCH FILE NAME, NUMBER OF STRIPS, NUMBER OF RESPONCES,
NUMBER OF FREQUENCIES)
% Reads the data in the punch file and stores it into a 3-d array with the following
index order
% (frequency index, strip number index, response index)

fp = fopen(fname);

% Loop over the strips

for istrip = 1:num_strips

    % Loop over the responses

    for iresponse = 1:num_responses

        % skip header line that which is not needed

        % read the first string
        string1 = fscanf(fp, '%s', 1);

        % identify the response
        acce = '$ACCE';
        if strcmp(string1, acce);
            line = fscanf(fp, '%*d %*d %*d %d', 1);
        else
            line = fscanf(fp, '%*s %*d %*d %*d %d', 1);
        end
    end
end

```

```

% read the real part of the response

data = fscanf(fp, '%f' , [4 num_frequencies]);

data1 = data(3,:);

% Skip header line which is not needed
% read the first string
string1 = fscanf(fp, '%s',1);

% identify the response
acce = '$ACCE';

if strcmp(string1,acce);
    line = fscanf(fp, '%*d %*d %*d %d',1);
else
    line = fscanf(fp, '%*s %*d %*d %*d %d',1);
end

% read the imaginary part of the data

data = fscanf(fp, '%f %f', [4 num_frequencies]);

% Arrange the data in a 3-d array (frequency index, strip number index, response
index)

frf(:,istrip,iresponse) = data1 + I*data(3,:);

% Close looping over the response
end

% Close looping over the strip number
end

%close the data file
fclose(fp);

% Write the frequency vector

frequency = data(2,:);

```

• Program gust_cross_spectra.m

```

function phil2 = gust_cross_spectra(omega,L,V,s,sigmaw)
% PHIL2 = GUST_CROSS_SPECTRA(OMEGA,L,V,S,SIGMAW)
% CALCULATES THE TWO DIMENSIONAL GUST LOAD CROSS SPECTRA BETWEEN TWO
% STRIPS A WITH A SEPARATION DISTANCE S. OMEGA IS THE FREQUENCY, V IS THE VELOCITY,
% L IS THE GUST SCALE OF TURBULANCE, AND SIGMAW IS THE RMS VALUE OF THE GUST VELOCITY.
Sigma = s/L;
r = sigma==0;
sigma = sigma+r;
nu = omega * L / V;
z = sigma .* sqrt(1 + ( 1.339 .* nu ) .^ 2 ) / 1.339;
phil2 = sqrt(2*pi)*sigmaw^2 * 2^(2/3) * L/( V * gamma(1/3) * (1.339) ^ (8/3) ) ...
    * (8*1.339^2 * sigma .^ (5/3) .* bessellk((5/6),z) ./ (3 * z .^ (5/6) ) ...
    - sigma .^ (11/3) .* bessellk((11/6),z) ./ z .^ (11/6) );
phiii = 2 *sigmaw^2 * L/V * ( 1 + 8/3 * ( 1.339 * nu ) .^ 2 ) ...
    ./ ( 1 + (1.339 * nu ) .^ 2 ) .^ (11/6);
phil2 = phil2 - r.* phil2 + r * phiii;

```

- **Program case_info.data**

number of strips	11
number of frequencies	351
number of responses	15
rms of gust velocity	1.000
forward velocity	8360
gust scale length	6000
nastran f06 file name	none
nastran pch file name	/home0/naser/bah/ha146c_full12.pch
strip coordinate file name	/home0/naser/bah/BAH_coor.dat

- **Program BAH_coor.dat**

strip no. 1	456.5000
strip no. 2	365.5000
strip no. 3	272.5000
strip no. 4	182.2500
strip no. 5	91.2500
strip no. 6	0
strip no. 7	-91.2500
strip no. 8	-182.2500
strip no. 9	-272.5000
strip no. 10	-365.5000
strip no. 11	-456.5000

APPENDIX H

MSC/NASTRAN input file used in the Discrete Gust Response Analysis of the Alliance airplane

```
$ TO EXECUTE THIS FILE USE THE FOLLOWING:
$ NAST705 VK01 SCRATCH=YES MEM=12MW NEWS=NO
$
SOL 146 $ AEROELASTIC DYNAMIC RESPONSE
$ DIAG = 8,15 $ MATRIX AND TABLE TRAILERS
TIME 120.0 $ TIME IN MINUTES
$
compile freqrs
alter 241 $
putsys (0, 209) $
alter 242 $
putsys (1, 209) $
CEND
$
TITLE = SEMISPAN MODEL * TRANSIENT ANALYSIS * M=0.090 * H=1000.0 FT.
SUBTITLE = SYMMETRIC RESPONSE FUEL 166.95LB. V=98.3 FT/SEC 8/8cbar
LABEL = 1-COSINE GUST, THIRTY-TWO MODES
$
METHOD = 1 $ SINV EIGENVALUE EXTRACTION METHOD
SPC = 1 $ BOUNDARY CONDITION CONSTRAINTS
SDAMPING = 25 $ MODAL STRUCTURAL DAMPING (TABDMP1)
FREQUENCY = 42 $ SET OF SOLUTION FORCING FREQUENCIES (FREQ1)
TSTEP = 41 $ SOLUTION TIME STEPS (1 PERIOD)
$RANDOM = 111 $ PSD SPECIFICATION (RANDPS)
K2PP = STIFF $ D.O.F. FOR OUTPUT OF VON KARMAN SPECTRUM (DMIG)
$ ECHO = UNSORT
ECHO = NONE $ SUPPRESS PRINTOUT OF BULK DATA DECK
$
OUTPUT
$
SET 40 = 9990,101,121,141
$ EXTRA POINT FOR GENERATION OF VON KARMAN PSD
DISPLACEMENT(SORT2,PLOT) = ALL
$SDISPLACEMENT(SORT2) = 40
SDISPLACEMENT(SORT2,PLOT) = ALL
$
SUBCASE 1 $ APPLY 1 - COS GUST
GUST = 1880 $ GUST SELECTION (GUST)
DLOAD = 2880 $ REQUIRED
OUTPUT(XYOUT)
XYPUNCH SDISP RESPONSE/9990(T1)
XYPUNCH DISP RESPONSE/101(T3)
XYPUNCH DISP RESPONSE/121(T3)
XYPUNCH DISP RESPONSE/141(T3)
$$$$$$$$$$$$$$$$$$$$
XYPUNCH ELFORCE RESPONSE / 101(3)
XYPUNCH ELFORCE RESPONSE / 101(4)
XYPUNCH ELFORCE RESPONSE / 101(5)
XYPUNCH ELFORCE RESPONSE / 101(6)
XYPUNCH ELFORCE RESPONSE / 101(7)
XYPUNCH ELFORCE RESPONSE / 101(8)
XYPUNCH ELFORCE RESPONSE / 101(9)
XYPUNCH ELFORCE RESPONSE / 121(3)
XYPUNCH ELFORCE RESPONSE / 121(4)
XYPUNCH ELFORCE RESPONSE / 121(5)
XYPUNCH ELFORCE RESPONSE / 121(6)
```



```

XYPUNCH ELFORCE RESPONSE / 121(7)
XYPUNCH ELFORCE RESPONSE / 121(8)
XYPUNCH ELFORCE RESPONSE / 121(9)
XYPUNCH ELFORCE RESPONSE / 140(3)
XYPUNCH ELFORCE RESPONSE / 140(4)
XYPUNCH ELFORCE RESPONSE / 140(5)
XYPUNCH ELFORCE RESPONSE / 140(6)
XYPUNCH ELFORCE RESPONSE / 140(7)
XYPUNCH ELFORCE RESPONSE / 140(8)
XYPUNCH ELFORCE RESPONSE / 140(9)
XYPUNCH ELFORCE RESPONSE / 217(3)
XYPUNCH ELFORCE RESPONSE / 217(4)
XYPUNCH ELFORCE RESPONSE / 217(5)
XYPUNCH ELFORCE RESPONSE / 217(6)
XYPUNCH ELFORCE RESPONSE / 217(7)
XYPUNCH ELFORCE RESPONSE / 217(8)
XYPUNCH ELFORCE RESPONSE / 217(9)
$$$$$$$$$$$$$$$$$$$$
XYPUNCH ACCE RESPONSE / 95(T1)
XYPUNCH ACCE RESPONSE / 95(T3)
XYPUNCH ACCE RESPONSE / 95(R2)
XYPUNCH ACCE RESPONSE / 121(T1)
XYPUNCH ACCE RESPONSE / 121(T3)
XYPUNCH ACCE RESPONSE / 121(R2)
XYPUNCH ACCE RESPONSE / 140(T1)
XYPUNCH ACCE RESPONSE / 140(T3)
XYPUNCH ACCE RESPONSE / 140(R2)
XYPUNCH ACCE RESPONSE / 217(T1)
XYPUNCH ACCE RESPONSE / 217(T3)
XYPUNCH ACCE RESPONSE / 217(R2)
$$$$$$$$$$$$$$$$$$$$
$
BEGIN BULK
$
$ INPUT UNITS: ARE INCHES, POUNDS, SECONDS FOR LENGTH, MASS, AND TIME
$
PARAM, POST, 0 $ XDB POST-PROCESSING
$
PARAM, LMODES, 32 $ USE THE 32 LOWEST NORMAL MODES
$
$ PARAM, VREF, 20.2537 $ CONVERT FROM IN/SEC TO KNOTS IN SOL 145
$ PARAM, VREF, 12.0 $ USE VELOCITY UNITS OF FEET/SECOND IN SOL 145
$
$ CHANGES "WEIGHT" INPUT DATA TO "MASS" DATA
PARAM,WTMASS,0.002588
$
$ REQUESTS MASS PROPERTIES SUMMARY
PARAM,GRDPNT,0 $ WITH RESPECT TO ORIGIN OF BASIC C.S.
$
$ DEFINE LOCAL COORDINATE SYSTEMS FOR HORIZONTAL AND VERTICAL TAILS
SPC1, 1, 123456, 30, 40 $ GRIDS 30 AND 40 ONLY USED FOR ORIENTATION
GRID, 30, 0, 379.75, 521.5678, 100.0 $ DEFINES DIRECTION OF Z-AXIS (H-TAIL)
GRID, 40, 0, 410.39, 587.3362, 100.0 $ DEFINES DIRECTION OF Z-AXIS (V-TAIL)
$
$ COORDINATE SYSTEM 12 IS A REFERENCE AXIS SYSTEM FOR STABILITY DERIVATIVES
CORD2R 12 0 156.51 0.0 48.98 156.51 0.0 40.0 +CO12
+CO12 140.0 0.0 48.98
$ LOCAL COORD. SYSTEM FOR HORIZONTAL TAIL
CORD1R, 5, 301, 30, 2301 $ Z-AXIS NORMAL TO PLANE OF HORIZ. TAIL
$ LOCAL COORD. SYSTEM FOR VERTICAL TAIL
CORD1R, 6, 401, 40, 2401 $ Z-AXIS NORMAL TO PLANE OF VERT. TAIL
$
$ LOCAL COORDINATE SYSTEM TO DEFINE Y-AXIS OF RIGHT H-TAIL HINGE LINE

```

```

CORD2R      13      0 404.480 525.50  77.360  404.480521.5678 100.0  +CO13
+CO13      450.0531.888378.46955
$  LOCAL COORDINATE SYSTEM TO DEFINE Y-AXIS OF RIGHT V-TAIL HINGE LINE
CORD2R      14      0 433.14  496.50 157.190  433.140614.1537 200.0  +CO14
+CO14      500.0497.3168154.9451
$
$  SELECT THE DESIRED BOUNDARY CONDITIONS
$  Fixed Root
$  SPC          1      101  123456      0.
$
$  Symmetric BC  *  CONSTRAIN GRIDS ON CENTERLINE
SPC          1      101      246      0.0      95      246      0.0
$
$  Antisymmetric BC
$  SPC          1      101  135      0.
$
$  *****
$  SECTION FOR DYNAMIC RESPONSE TO GUST LOADING
$  *****
$
PARAM, MACH, 0.090  $ DESIRED MACH NUMBER
PARAM, Q, 0.077444  $ DYNAMIC PRESSURE IN PSI AT 1000 FT. (V=1179.6 IN/SEC)
PARAM, GUSTAERO, -1
$
$  STRUCTURAL MODAL DAMPING = 0.02 IN EACH MODE
TABDMP1      25      G
+TDMP1      0.0      0.02      60.0      0.02      ENDT
$
$  *****
$  FOLLOWING GROUP OF INPUT IS FOR THE VON KARMAN PSD
$
$RANDPS      111      1      1      1.0      0.0      121
$  VON KARMAN GUST WITH (L/U)=10.1729 SEC., AND WG=1.0 IN/SEC
$TABRNDG      121      1 10.1729      1.0
$  VELOCITY ON 'GUST' MUST BE SAME AS ON 'AERO' INPUT RECORD.
$GUST        36      468.4774-4      0.0  1179.6
$  SID      DLOAD      WG      X0      V
$GUST      1000      2000      23.58  -472.  2360.
$  2      3      4      5      6      7      8      9      1
$2345678123456781234567812345678123456781234567812345678123456787
GUST      1180      2180      1.0      0.0  1179.6
GUST      1280      2280      1.0      0.0  1179.6
GUST      1380      2380      1.0      0.0  1179.6
GUST      1480      2480      1.0      0.0  1179.6
GUST      1580      2580      1.0      0.0  1179.6
GUST      1680      2680      1.0      0.0  1179.6
GUST      1780      2780      1.0      0.0  1179.6
GUST      1880      2880      1.0      0.0  1179.6
$
$  TLOAD2 DEFINES A TIME DEPENDENT DYNAMIC LOAD OR ENFORCED MOTION.
$  LISTED ARE THE ID, DAREA ID, DELAY ID, TYPE OF DYNAMIC EXCITATION,
$  AND AN ANALYTICAL FUNCTION.
$
$  2      3      4      5      6      7      8      9      1
$2345678123456781234567812345678123456781234567812345678123456787
$  SID      DAREA      DELAY      TYPE      T1      T2      F      P
$ 1d8
tload2  1181      1002      .2      .335109 0.      0.
0.      0.
tload2  1182      1002      .2      .335109 7.4014120.
0.      0.
dload   2180      0.5      1.      1181      -1.      1182
$ 2d8

```



```

FREQ1      42      0.00      0.05      400
$
$ SETS OF FREQUENCIES USED IN SOLUTION OF FREQUENCY RESPONSE PROBLEMS
$FREQ1      41      0.0001      0.0001      9
$FREQ1      41      0.001      0.001      9
$FREQ1      41      0.010      0.010      9
$FREQ1      41      0.10      0.05      1198
$ DMIG DEFINES AN EPOINT USED TO OUTPUT THE VON KARMAN PSD
DMIG      STIFF      0      6      1      0
DMIG      STIFF      9990      0      9990      0      1.0
$
$ *****
$ END OF SECTION FOR DYNAMIC RESPONSE TO GUST LOADING
$ *****
$ *****
$ BEGIN AERODYNAMIC FLUTTER CARDS
$ *****
$ VALUE OF FIELD 6 (SYMxz) IS 1 FOR SYM CASE, -1 FOR ASYM, 0 FOR FIXED
$      2      3      4      5      6      7      8      9      1
$2345678123456781234567812345678123456781234567812345678123456787
$ AERO. DENSITY UNITS: LB-SEC**2/IN**4 (SEA-LEVEL)
AERO      0      1179.6      51.001.1463-7      1      0
$
$ Inboard Wing (RIGHT SIDE)
CAERO1      10001      1      0      17      8      1      +CA101
+CA101      132.83      0.0      48.98      59.2      134.33      223.5      60.77      54.03
$
$GRID      101      0      156.51      0.00      48.98
$ (156.51-132.83)/59.2=0.40 chord
$
$ Outboard Wing (RIGHT SIDE)
CAERO1      20001      1      0      23      8      1      +CA102
+CA102      134.33      223.5      60.77      54.03      138.03      525.5      76.79      41.28
$
$GRID      118      0      155.94      223.50      60.77
$ (155.94-134.33)/54.03=0.40 chord
$
$ RIGHT-SIDE HORIZONTAL TAIL
$ THE H-TAIL PANEL SPANS THE AREA FROM THE LEADING EDGE TO THE HINGE LINE
CAERO1      30001      1      0      20      8      1      +CA103
+CA103      355.08      525.5      77.36      49.40      366.04      620.5      93.92      24.704
$
$ RIGHT-SIDE CONTROL SURFACE PANEL ON HORIZONTAL TAIL
CAERO1      31001      1      0      20      2      1      +CA103A
+CA103A      404.480      525.50      77.360      12.35      390.744      620.50      93.920      6.176
$
$GRID      301      0      379.75      525.50      77.36
$ (379.75-355.08)/61.75=0.40 chord
$
$ RIGHT-SIDE VERTICAL TAIL
$ CAERO1      40001      1      0      16      8      1      +CA104
$ +CA104      390.67      525.5      77.5      49.3      407.54      496.5      157.19      32.00
$
$ REDEFINE POINTS 1 AND 4 FOR VERTICAL TAIL (SWAP POINTS 1 AND 4)
CAERO1      40001      1      0      20      8      1      +CA104
+CA104      407.54      496.5      157.19      25.60      390.67      525.5      77.5      39.44
$
$ RIGHT-SIDE CONTROL SURFACE PANEL ON VERTICAL TAIL
CAERO1      41001      1      0      20      2      1      +CA104A
+CA104A      433.140      496.50      157.190      6.40      430.110      525.50      77.50      9.86
$

```

```

$GRID 401 0 410.39 525.50 77.50
$ (410.39-390.67)/49.30=0.40 chord
$
$          DENS  MACH  VEL  INTERP  MODES  PK TOL (0.001 default)
FLUTTER 30      PK    1     2     4     L      10
FLFACT  1      1.0
FLFACT  2      0.0
$
$ FOR PK METHOD, 'FLFACT 4' IS A VELOCITY TABLE (UNITS IN/SEC)
$ A MINUS SIGN FOR A VELOCITY IS A REQUEST FOR EIGENVALUE OUTPUT
FLFACT  4      176.0  528.0  880.0  1320.0  1760.0  2640.0  3520.0  +FL01
+FL01    4400.0  5280.0  6200.0  7040.0
$
$ TABLES OF MACH NUMBER AND REDUCED FREQUENCY
MKAERO1 0.09                                     +MK1
+MK1    0.00001  0.005  0.01  0.02  0.04  0.06  0.08  0.1
MKAERO1 0.09                                     +MK2
+MK2    0.2     0.4   0.6   0.8   1.0   2.0   3.0   4.0
MKAERO1 0.09                                     +MK3
+MK3    5.0     6.0   7.0   8.0   9.0   10.0
$
PAERO1 1
$
$ TEST USAGE OF SURFACE SPLINES ON ALL LIFTING SURFACES
$ SPLINE1 = 100 RIGHT-SIDE INBOARD WING
$ SPLINE1 = 200 RIGHT-SIDE OUTBOARD WING
$ SPLINE1 = 300 RIGHT-SIDE HORIZONTAL TAIL WITHOUT CONTROL SURFACE
$ SPLINE1 = 305 RIGHT-SIDE CONTROL SURFACE ON HORIZONTAL TAIL
$ SPLINE1 = 400 RIGHT-SIDE VERTICAL TAIL WITHOUT CONTROL SURFACE
$ SPLINE1 = 405 RIGHT-SIDE CONTROL SURFACE ON VERTICAL TAIL
$
SPLINE1 100 10001 10001 10136 100
SPLINE1 200 20001 20001 20184 200
$
SPLINE1 300 30001 30001 30160 300
SPLINE1 400 40001 40001 40160 400
$
SPLINE1 305 31001 31001 31040 305
SPLINE1 405 41001 41001 41040 405
$
$ GRIDS UTILIZED FOR RIGHT SIDE INBOARD WING SURFACE SPLINES
SET1 100 101 102 103 104 105 106 107+IW01
+IW01 108 109 110 111 112 113 114 115+IW02
+IW02 116 117 118 1101 1102 1103 1104 1105+IW03
+IW03 1106 1107 1108 1109 1110 1111 1112 1113+IW04
+IW04 1114 1115 1116 1117 1118 2101 2102 2103+IW05
+IW05 2104 2105 2106 2107 2108 2109 2110 2111+IW06
+IW06 2112 2113 2114 2115 2116 2117 2118
$
$ GRIDS UTILIZED FOR RIGHT SIDE OUTBOARD WING SURFACE SPLINES
SET1 200 118 119 120 121 122 123 124+OW01
+OW01 125 126 127 128 129 130 131 132+OW02
+OW02 133 134 135 136 137 138 139 140+OW03
+OW03 141 1118 1119 1120 1121 1122 1123 1124+OW04
+OW04 1125 1126 1127 1128 1129 1130 1131 1132+OW05
+OW05 1133 1134 1135 1136 1137 1138 1139 1140+OW06
+OW06 1141 2118 2119 2120 2121 2122 2123 2124+OW07
+OW07 2125 2126 2127 2128 2129 2130 2131 2132+OW08
+OW08 2133 2134 2135 2136 2137 2138 2139 2140+OW09
+OW09 2141
$
$ GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON H-TAIL
SET1 300 301 302 303 304 305 306 307+HT01
+HT01 308 309 310 311 1301 1302 1303 1304+HT02
+HT02 1305 1306 1307 1308 1309 1310 1311 2501+HT03

```

```

+HT03      2502      2503      2504      2505      2506      2507      2508      2509+HT04
+HT04      2510      2511
$ GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON H-TAIL CONTROL SURFACE
SET1       305      2501      2502      2503      2504      2505      2506      2507+HC01
+HC01      2508      2509      2510      2511      2301      2302      2303      2304+HC02
+HC02      2305      2306      2307      2308      2309      2310      2311
$ GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON V-TAIL
SET1       400      401      402      403      404      405      406      407+VT01
+VT01      408      409      410      411      1401      1402      1403      1404+VT02
+VT02      1405      1406      1407      1408      1409      1410      1411      2601+VT03
+VT03      2602      2603      2604      2605      2606      2607      2608      2609+VT04
+VT04      2610      2611
$ GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON V-TAIL CONTROL SURFACE
SET1       405      2601      2602      2603      2604      2605      2606      2607+VC01
+VC01      2608      2609      2610      2611      2401      2402      2403      2404+VC02
+VC02      2405      2406      2407      2408      2409      2410      2411
$
$ ***** END OF AERODYNAMIC FLUTTER INPUTS *****
$
EIGR       1      SINV      0.0      60.0      40
$
$ CREATE A NEW GRID POINT AT THE C.G. FOR THE CURRENT FUEL MASS CONDITION
$ USE A CBEAM TO CONNECT THIS NEW GRID TO GRID 101
GRID       95      0160.9484      0.077.08521      0
CBEAM      95      95      101      95      1.0      0.0      0.0
PBEAM      95      1      100.0      1000.0      1000.0      0.0      1000.0
$
$ GRID 100 REPRESENTS PROPULSION SYSTEM
RBE2       504      101      123456      100
$ CONNECTIONS TO WING-TIP BOOM, HORIZONTAL AND VERTICAL TAILS
$
RBE2       501      141      123456      216
RBE2       502      238      123456      301
RBE2       503      240      123456      401
$
GRID       100      0      125.8      0.0      86.1      0
$
$ GRIDS FOR RIGHT WING BEAM
$
GRID       101      0      156.51      0.00      48.98      0
GRID       102      0      156.48      13.15      49.67      0
GRID       103      0      156.45      26.29      50.37      0
GRID       104      0      156.41      39.44      51.06      0
GRID       105      0      156.38      52.59      51.75      0
GRID       106      0      156.34      65.74      52.45      0
GRID       107      0      156.31      78.88      53.14      0
GRID       108      0      156.28      92.03      53.83      0
GRID       109      0      156.24      105.18      54.53      0
GRID       110      0      156.21      118.32      55.22      0
GRID       111      0      156.18      131.47      55.91      0
GRID       112      0      156.14      144.62      56.61      0
GRID       113      0      156.11      157.76      57.30      0
GRID       114      0      156.08      170.91      57.99      0
GRID       115      0      156.04      184.06      58.69      0
GRID       116      0      156.01      197.21      59.38      0
GRID       117      0      155.98      210.35      60.07      0
GRID       118      0      155.94      223.50      60.77      0
GRID       119      0      155.88      236.63      61.46      0
GRID       120      0      155.82      249.76      62.16      0
GRID       121      0      155.76      262.89      62.86      0
GRID       122      0      155.70      276.02      63.55      0
GRID       123      0      155.64      289.15      64.25      0
GRID       124      0      155.58      302.28      64.95      0

```

GRID	125	0	155.52	315.41	65.64	0
GRID	126	0	155.46	328.54	66.34	0
GRID	127	0	155.39	341.67	67.04	0
GRID	128	0	155.33	354.80	67.73	0
GRID	129	0	155.27	367.93	68.43	0
GRID	130	0	155.21	381.07	69.13	0
GRID	131	0	155.15	394.20	69.82	0
GRID	132	0	155.09	407.33	70.52	0
GRID	133	0	155.03	420.46	71.22	0
GRID	134	0	154.97	433.59	71.91	0
GRID	135	0	154.91	446.72	72.61	0
GRID	136	0	154.85	459.85	73.31	0
GRID	137	0	154.79	472.98	74.00	0
GRID	138	0	154.72	486.11	74.70	0
GRID	139	0	154.66	499.24	75.40	0
GRID	140	0	154.60	512.37	76.09	0
GRID	141	0	154.54	525.50	76.79	0

\$

\$ RIGHT SIDE WING SURFACE LEADING-EDGE GRID POINTS

\$

GRID	1101	0	132.83	0.00	48.98	0
GRID	1102	0	132.92	13.15	49.67	0
GRID	1103	0	133.01	26.29	50.37	0
GRID	1104	0	133.10	39.44	51.06	0
GRID	1105	0	133.18	52.59	51.75	0
GRID	1106	0	133.27	65.74	52.45	0
GRID	1107	0	133.36	78.88	53.14	0
GRID	1108	0	133.45	92.03	53.83	0
GRID	1109	0	133.54	105.18	54.53	0
GRID	1110	0	133.63	118.32	55.22	0
GRID	1111	0	133.71	131.47	55.91	0
GRID	1112	0	133.80	144.62	56.61	0
GRID	1113	0	133.89	157.76	57.30	0
GRID	1114	0	133.98	170.91	57.99	0
GRID	1115	0	134.07	184.06	58.69	0
GRID	1116	0	134.16	197.21	59.38	0
GRID	1117	0	134.24	210.35	60.07	0
GRID	1118	0	134.33	223.50	60.77	0
GRID	1119	0	134.49	236.63	61.46	0
GRID	1120	0	134.65	249.76	62.16	0
GRID	1121	0	134.81	262.89	62.86	0
GRID	1122	0	134.97	276.02	63.55	0
GRID	1123	0	135.14	289.15	64.25	0
GRID	1124	0	135.30	302.28	64.95	0
GRID	1125	0	135.46	315.41	65.64	0
GRID	1126	0	135.62	328.54	66.34	0
GRID	1127	0	135.78	341.67	67.04	0
GRID	1128	0	135.94	354.80	67.73	0
GRID	1129	0	136.10	367.93	68.43	0
GRID	1130	0	136.26	381.07	69.13	0
GRID	1131	0	136.42	394.20	69.82	0
GRID	1132	0	136.58	407.33	70.52	0
GRID	1133	0	136.74	420.46	71.22	0
GRID	1134	0	136.90	433.59	71.91	0
GRID	1135	0	137.06	446.72	72.61	0
GRID	1136	0	137.22	459.85	73.31	0
GRID	1137	0	137.38	472.98	74.00	0
GRID	1138	0	137.55	486.11	74.70	0
GRID	1139	0	137.71	499.24	75.40	0
GRID	1140	0	137.87	512.37	76.09	0
GRID	1141	0	138.03	525.50	76.79	0

\$

\$ RIGHT SIDE WING SURFACE TRAILING-EDGE GRID POINTS

\$						
GRID	2101	0	192.03	0.00	48.98	0
GRID	2102	0	191.82	13.15	49.67	0
GRID	2103	0	191.60	26.29	50.37	0
GRID	2104	0	191.39	39.44	51.06	0
GRID	2105	0	191.17	52.59	51.75	0
GRID	2106	0	190.95	65.74	52.45	0
GRID	2107	0	190.74	78.88	53.14	0
GRID	2108	0	190.52	92.03	53.83	0
GRID	2109	0	190.30	105.18	54.53	0
GRID	2110	0	190.09	118.32	55.22	0
GRID	2111	0	189.87	131.47	55.91	0
GRID	2112	0	189.66	144.62	56.61	0
GRID	2113	0	189.44	157.76	57.30	0
GRID	2114	0	189.22	170.91	57.99	0
GRID	2115	0	189.01	184.06	58.69	0
GRID	2116	0	188.79	197.21	59.38	0
GRID	2117	0	188.58	210.35	60.07	0
GRID	2118	0	188.36	223.50	60.77	0
GRID	2119	0	187.97	236.63	61.46	0
GRID	2120	0	187.57	249.76	62.16	0
GRID	2121	0	187.18	262.89	62.86	0
GRID	2122	0	186.79	276.02	63.55	0
GRID	2123	0	186.39	289.15	64.25	0
GRID	2124	0	186.00	302.28	64.95	0
GRID	2125	0	185.61	315.41	65.64	0
GRID	2126	0	185.21	328.54	66.34	0
GRID	2127	0	184.82	341.67	67.04	0
GRID	2128	0	184.43	354.80	67.73	0
GRID	2129	0	184.03	367.93	68.43	0
GRID	2130	0	183.64	381.07	69.13	0
GRID	2131	0	183.25	394.20	69.82	0
GRID	2132	0	182.85	407.33	70.52	0
GRID	2133	0	182.46	420.46	71.22	0
GRID	2134	0	182.07	433.59	71.91	0
GRID	2135	0	181.67	446.72	72.61	0
GRID	2136	0	181.28	459.85	73.31	0
GRID	2137	0	180.89	472.98	74.00	0
GRID	2138	0	180.49	486.11	74.70	0
GRID	2139	0	180.10	499.24	75.40	0
GRID	2140	0	179.71	512.37	76.09	0
GRID	2141	0	179.31	525.50	76.79	0

\$

\$ RIGHT WING * LEADING AND TRAILING EDGE GRIDS ARE DEPENDENT ON MAIN BEAM

\$

RBE2	1201	101	123456	1101	2101
RBE2	1202	102	123456	1102	2102
RBE2	1203	103	123456	1103	2103
RBE2	1204	104	123456	1104	2104
RBE2	1205	105	123456	1105	2105
RBE2	1206	106	123456	1106	2106
RBE2	1207	107	123456	1107	2107
RBE2	1208	108	123456	1108	2108
RBE2	1209	109	123456	1109	2109
RBE2	1210	110	123456	1110	2110
RBE2	1211	111	123456	1111	2111
RBE2	1212	112	123456	1112	2112
RBE2	1213	113	123456	1113	2113
RBE2	1214	114	123456	1114	2114
RBE2	1215	115	123456	1115	2115
RBE2	1216	116	123456	1116	2116
RBE2	1217	117	123456	1117	2117
RBE2	1218	118	123456	1118	2118

RBE2	1219	119	123456	1119	2119
RBE2	1220	120	123456	1120	2120
RBE2	1221	121	123456	1121	2121
RBE2	1222	122	123456	1122	2122
RBE2	1223	123	123456	1123	2123
RBE2	1224	124	123456	1124	2124
RBE2	1225	125	123456	1125	2125
RBE2	1226	126	123456	1126	2126
RBE2	1227	127	123456	1127	2127
RBE2	1228	128	123456	1128	2128
RBE2	1229	129	123456	1129	2129
RBE2	1230	130	123456	1130	2130
RBE2	1231	131	123456	1131	2131
RBE2	1232	132	123456	1132	2132
RBE2	1233	133	123456	1133	2133
RBE2	1234	134	123456	1134	2134
RBE2	1235	135	123456	1135	2135
RBE2	1236	136	123456	1136	2136
RBE2	1237	137	123456	1137	2137
RBE2	1238	138	123456	1138	2138
RBE2	1239	139	123456	1139	2139
RBE2	1240	140	123456	1140	2140
RBE2	1241	141	123456	1141	2141

\$

\$ GRIDS FOR RIGHT SIDE WING-TIP BOOM

\$

GRID	201	0	25.	525.5	77.5	0
GRID	202	0	33.6111	525.5	77.5	0
GRID	203	0	42.2222	525.5	77.5	0
GRID	204	0	50.8333	525.5	77.5	0
GRID	205	0	59.4444	525.5	77.5	0
GRID	206	0	68.0556	525.5	77.5	0
GRID	207	0	76.6667	525.5	77.5	0
GRID	208	0	85.2778	525.5	77.5	0
GRID	209	0	93.8889	525.5	77.5	0
GRID	210	0	102.5	525.5	77.5	0
GRID	211	0	111.111	525.5	77.5	0
GRID	212	0	119.722	525.5	77.5	0
GRID	213	0	128.333	525.5	77.5	0
GRID	214	0	136.944	525.5	77.5	0
GRID	215	0	145.556	525.5	77.5	0
GRID	216	0	154.167	525.5	77.5	0
GRID	217	0	162.778	525.5	77.5	0
GRID	218	0	171.389	525.5	77.5	0
GRID	219	0	180.	525.5	77.5	0
GRID	220	0	190.	525.5	77.5	0
GRID	221	0	200.	525.5	77.5	0
GRID	222	0	210.	525.5	77.5	0
GRID	223	0	220.	525.5	77.5	0
GRID	224	0	230.	525.5	77.5	0
GRID	225	0	240.	525.5	77.5	0
GRID	226	0	250.	525.5	77.5	0
GRID	227	0	260.	525.5	77.5	0
GRID	228	0	270.	525.5	77.5	0
GRID	229	0	280.	525.5	77.5	0
GRID	230	0	290.	525.5	77.5	0
GRID	231	0	300.	525.5	77.5	0
GRID	232	0	310.	525.5	77.5	0
GRID	233	0	320.	525.5	77.5	0
GRID	234	0	330.	525.5	77.5	0
GRID	235	0	340.	525.5	77.5	0
GRID	236	0	350.	525.5	77.5	0
GRID	237	0	360.	525.5	77.5	0

GRID	238	0	370.	525.5	77.5	0
GRID	239	0	380.	525.5	77.5	0
GRID	240	0	390.	525.5	77.5	0
GRID	241	0	400.	525.5	77.5	0
GRID	242	0	410.	525.5	77.5	0
GRID	243	0	420.	525.5	77.5	0

\$

\$ RIGHT SIDE HORIZONTAL TAIL DEFINITION

\$ GRIDS FOR RIGHT SIDE HORIZONTAL TAIL BEAM

\$

GRID	301	0	379.75	525.50	77.36	0
GRID	302	0	379.61	535.00	79.01	0
GRID	303	0	379.47	544.50	80.67	0
GRID	304	0	379.34	554.00	82.33	0
GRID	305	0	379.20	563.50	83.98	0
GRID	306	0	379.06	573.00	85.64	0
GRID	307	0	378.92	582.50	87.30	0
GRID	308	0	378.79	592.00	88.95	0
GRID	309	0	378.65	601.50	90.61	0
GRID	310	0	378.51	611.00	92.27	0
GRID	311	0	378.37	620.50	93.92	0

\$ DUPLICATE GRIDS FOR HORIZONTAL TAIL MAIN BEAM

\$ THE OUTPUT OF THESE GRIDS WILL BE IN COORD. SYST. 5

GRID	331	0	379.75	525.50	77.36	5
GRID	332	0	379.61	535.00	79.01	5
GRID	333	0	379.47	544.50	80.67	5
GRID	334	0	379.34	554.00	82.33	5
GRID	335	0	379.20	563.50	83.98	5
GRID	336	0	379.06	573.00	85.64	5
GRID	337	0	378.92	582.50	87.30	5
GRID	338	0	378.79	592.00	88.95	5
GRID	339	0	378.65	601.50	90.61	5
GRID	340	0	378.51	611.00	92.27	5
GRID	341	0	378.37	620.50	93.92	5

\$ DUPLICATE GRIDS ON H-TAIL ARE DEPENDENT ON ELASTIC AXIS BEAM

RBE2	521	301	123456	331
RBE2	522	302	123456	332
RBE2	523	303	123456	333
RBE2	524	304	123456	334
RBE2	525	305	123456	335
RBE2	526	306	123456	336
RBE2	527	307	123456	337
RBE2	528	308	123456	338
RBE2	529	309	123456	339
RBE2	530	310	123456	340
RBE2	531	311	123456	341

\$

\$ RIGHT SIDE HORIZONTAL TAIL LEADING EDGE

\$

GRID	1301	0	355.08	525.50	77.36	0
GRID	1302	0	356.17	535.00	79.01	0
GRID	1303	0	357.27	544.50	80.67	0
GRID	1304	0	358.36	554.00	82.33	0
GRID	1305	0	359.46	563.50	83.98	0
GRID	1306	0	360.56	573.00	85.64	0
GRID	1307	0	361.65	582.50	87.30	0
GRID	1308	0	362.75	592.00	88.95	0
GRID	1309	0	363.85	601.50	90.61	0
GRID	1310	0	364.94	611.00	92.27	0
GRID	1311	0	366.04	620.50	93.92	0

\$

\$ DISPLACEMENT OF H-TAIL L.E. IS DEPENDENT ON ELASTIC AXIS

RBE2	1251	301	123456	1301
RBE2	1252	302	123456	1302
RBE2	1253	303	123456	1303
RBE2	1254	304	123456	1304
RBE2	1255	305	123456	1305
RBE2	1256	306	123456	1306
RBE2	1257	307	123456	1307
RBE2	1258	308	123456	1308
RBE2	1259	309	123456	1309
RBE2	1260	310	123456	1310
RBE2	1261	311	123456	1311

\$

\$ DUPLICATE GRIDS FOR HORIZONTAL TAIL LEADING EDGE

\$ THE OUTPUT OF THESE GRIDS WILL BE IN COORD. SYST. 5

GRID	1331	0	355.08	525.50	77.36	5
GRID	1332	0	356.17	535.00	79.01	5
GRID	1333	0	357.27	544.50	80.67	5
GRID	1334	0	358.36	554.00	82.33	5
GRID	1335	0	359.46	563.50	83.98	5
GRID	1336	0	360.56	573.00	85.64	5
GRID	1337	0	361.65	582.50	87.30	5
GRID	1338	0	362.75	592.00	88.95	5
GRID	1339	0	363.85	601.50	90.61	5
GRID	1340	0	364.94	611.00	92.27	5
GRID	1341	0	366.04	620.50	93.92	5

\$ DUPLICATE GRIDS ON H-TAIL LEADING EDGE ARE DEPENDENT ON ELASTIC AXIS

RBE2	541	301	123456	1331
RBE2	542	302	123456	1332
RBE2	543	303	123456	1333
RBE2	544	304	123456	1334
RBE2	545	305	123456	1335
RBE2	546	306	123456	1336
RBE2	547	307	123456	1337
RBE2	548	308	123456	1338
RBE2	549	309	123456	1339
RBE2	550	310	123456	1340
RBE2	551	311	123456	1341

\$

\$ RIGHT SIDE HORIZONTAL TAIL TRAILING EDGE

\$

GRID	2301	0	416.83	525.50	77.36	0
GRID	2302	0	414.84	535.00	79.01	0
GRID	2303	0	412.85	544.50	80.67	0
GRID	2304	0	410.86	554.00	82.33	0
GRID	2305	0	408.87	563.50	83.98	0
GRID	2306	0	406.88	573.00	85.64	0
GRID	2307	0	404.88	582.50	87.30	0
GRID	2308	0	402.89	592.00	88.95	0
GRID	2309	0	400.90	601.50	90.61	0
GRID	2310	0	398.91	611.00	92.27	0
GRID	2311	0	396.92	620.50	93.92	0

\$ DUPLICATE GRIDS FOR HORIZONTAL TAIL TRAILING EDGE

\$ THE OUTPUT FOR THESE GRIDS WILL BE IN COORD. SYST. 5

GRID	2331	0	416.83	525.50	77.36	5
GRID	2332	0	414.84	535.00	79.01	5
GRID	2333	0	412.85	544.50	80.67	5
GRID	2334	0	410.86	554.00	82.33	5
GRID	2335	0	408.87	563.50	83.98	5
GRID	2336	0	406.88	573.00	85.64	5
GRID	2337	0	404.88	582.50	87.30	5
GRID	2338	0	402.89	592.00	88.95	5
GRID	2339	0	400.90	601.50	90.61	5

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GRID      2340      0 398.91 611.00 92.27      5
GRID      2341      0 396.92 620.50 93.92      5
$  DUPLICATE H-TAIL T.E. GRIDS ARE DEPENDENT ON ORIGINAL T.E. GRIDS
RBE2      561      2301 123456 2331
RBE2      562      2302 123456 2332
RBE2      563      2303 123456 2333
RBE2      564      2304 123456 2334
RBE2      565      2305 123456 2335
RBE2      566      2306 123456 2336
RBE2      567      2307 123456 2337
RBE2      568      2308 123456 2338
RBE2      569      2309 123456 2339
RBE2      570      2310 123456 2340
RBE2      571      2311 123456 2341
$
$  GRIDS AT 80% CHORD HINGE-LINE OF RIGHT SIDE HORIZONTAL TAIL
GRID      2501      0 404.480 525.500 77.360      0
GRID      2502      0 403.106 535.000 79.010      0
GRID      2503      0 401.734 544.500 80.670      0
GRID      2504      0 400.360 554.000 82.330      0
GRID      2505      0 398.988 563.500 83.980      0
GRID      2506      0 397.616 573.000 85.640      0
GRID      2507      0 396.234 582.500 87.300      0
GRID      2508      0 394.862 592.000 88.950      0
GRID      2509      0 393.490 601.500 90.610      0
GRID      2510      0 392.116 611.000 92.270      0
GRID      2511      0 390.744 620.500 93.920      0
$
$  *****
$  END OF RIGHT SIDE HORIZONTAL TAIL DEFINITION
$  *****
$
$  *****
$  RIGHT SIDE VERTICAL TAIL DEFINITION
$  *****
$
$  GRIDS FOR RIGHT SIDE VERTICAL TAIL BEAM
GRID      401      0 410.39 525.50 77.50      0
GRID      402      0 411.39 522.60 85.47      0
GRID      403      0 412.38 519.70 93.44      0
GRID      404      0 413.38 516.80 101.41     0
GRID      405      0 414.37 513.90 109.38     0
GRID      406      0 415.37 511.00 117.34     0
GRID      407      0 416.36 508.10 125.31     0
GRID      408      0 417.36 505.20 133.28     0
GRID      409      0 418.35 502.30 141.25     0
GRID      410      0 419.35 499.40 149.22     0
GRID      411      0 420.34 496.50 157.19     0
$  THIS GROUP OF GRIDS GENERATES OUTPUT IN COORD. SYSTEM 6
$  THE Z-AXIS FOR COORD. SYS. 5 IS NORMAL TO PLANE OF V-TAIL
GRID      431      0 410.39 525.50 77.50      6
GRID      432      0 411.39 522.60 85.47      6
GRID      433      0 412.38 519.70 93.44      6
GRID      434      0 413.38 516.80 101.41     6
GRID      435      0 414.37 513.90 109.38     6
GRID      436      0 415.37 511.00 117.34     6
GRID      437      0 416.36 508.10 125.31     6
GRID      438      0 417.36 505.20 133.28     6
GRID      439      0 418.35 502.30 141.25     6
GRID      440      0 419.35 499.40 149.22     6
GRID      441      0 420.34 496.50 157.19     6
$  DUPLICATE GRIDS OF MAIN V-TAIL ARE DEPENDENT ON ELASTIC AXIS GRIDS
RBE2      581      401 123456 431

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RBE2	582	402	123456	432
RBE2	583	403	123456	433
RBE2	584	404	123456	434
RBE2	585	405	123456	435
RBE2	586	406	123456	436
RBE2	587	407	123456	437
RBE2	588	408	123456	438
RBE2	589	409	123456	439
RBE2	590	410	123456	440
RBE2	591	411	123456	441

\$

\$ RIGHT SIDE VERTICAL TAIL LEADING EDGE

\$

GRID	1401	0	390.67	525.50	77.50	0
GRID	1402	0	392.36	522.60	85.47	0
GRID	1403	0	394.05	519.70	93.44	0
GRID	1404	0	395.73	516.80	101.41	0
GRID	1405	0	397.42	513.90	109.38	0
GRID	1406	0	399.11	511.00	117.34	0
GRID	1407	0	400.79	508.10	125.31	0
GRID	1408	0	402.48	505.20	133.28	0
GRID	1409	0	404.17	502.30	141.25	0
GRID	1410	0	405.85	499.40	149.22	0
GRID	1411	0	407.54	496.50	157.19	0

\$

\$ LEADING EDGE V-TAIL GRIDS ARE DEPENDENT ON ELASTIC AXIS

RBE2	1271	401	123456	1401
RBE2	1272	402	123456	1402
RBE2	1273	403	123456	1403
RBE2	1274	404	123456	1404
RBE2	1275	405	123456	1405
RBE2	1276	406	123456	1406
RBE2	1277	407	123456	1407
RBE2	1278	408	123456	1408
RBE2	1279	409	123456	1409
RBE2	1280	410	123456	1410
RBE2	1281	411	123456	1411

\$

\$ DUPLICATE GRIDS FOR VERTICAL TAIL LEADING EDGE

\$ THE OUTPUT OF THESE GRIDS WILL BE IN COORD. SYST. 6

GRID	1431	0	390.67	525.50	77.50	6
GRID	1432	0	392.36	522.60	85.47	6
GRID	1433	0	394.05	519.70	93.44	6
GRID	1434	0	395.73	516.80	101.41	6
GRID	1435	0	397.42	513.90	109.38	6
GRID	1436	0	399.11	511.00	117.34	6
GRID	1437	0	400.79	508.10	125.31	6
GRID	1438	0	402.48	505.20	133.28	6
GRID	1439	0	404.17	502.30	141.25	6
GRID	1440	0	405.85	499.40	149.22	6
GRID	1441	0	407.54	496.50	157.19	6

\$ V-TAIL LEADING EDGE DUPLICATE GRIDS ARE DEPENDENT ON ELASTIC AXIS GRIDS

RBE2	601	401	123456	1431
RBE2	602	402	123456	1432
RBE2	603	403	123456	1433
RBE2	604	404	123456	1434
RBE2	605	405	123456	1435
RBE2	606	406	123456	1436
RBE2	607	407	123456	1437
RBE2	608	408	123456	1438
RBE2	609	409	123456	1439
RBE2	610	410	123456	1440
RBE2	611	411	123456	1441

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$
$ RIGHT SIDE VERTICAL TAIL TRAILING EDGE
$
GRID      2401      0  439.97  525.50   77.50      0
GRID      2402      0  439.93  522.60   85.47      0
GRID      2403      0  439.89  519.70   93.44      0
GRID      2404      0  439.84  516.80  101.41      0
GRID      2405      0  439.80  513.90  109.38      0
GRID      2406      0  439.76  511.00  117.34      0
GRID      2407      0  439.71  508.10  125.31      0
GRID      2408      0  439.67  505.20  133.28      0
GRID      2409      0  439.63  502.30  141.25      0
GRID      2410      0  439.58  499.40  149.22      0
GRID      2411      0  439.54  496.50  157.19      0
$ DUPLICATE GRIDS FOR VERTICAL TAIL TRAILING EDGE
$ THE OUTPUT FOR THESE GRIDS WILL BE IN COORD. SYST. 6
GRID      2431      0  439.97  525.50   77.50      6
GRID      2432      0  439.93  522.60   85.47      6
GRID      2433      0  439.89  519.70   93.44      6
GRID      2434      0  439.84  516.80  101.41      6
GRID      2435      0  439.80  513.90  109.38      6
GRID      2436      0  439.76  511.00  117.34      6
GRID      2437      0  439.71  508.10  125.31      6
GRID      2438      0  439.67  505.20  133.28      6
GRID      2439      0  439.63  502.30  141.25      6
GRID      2440      0  439.58  499.40  149.22      6
GRID      2441      0  439.54  496.50  157.19      6
$ DUPLICATE V-TAIL T.E. GRIDS ARE DEPENDENT ON ORIGINAL GRIDS
RBE2      621      2401  123456   2431
RBE2      622      2402  123456   2432
RBE2      623      2403  123456   2433
RBE2      624      2404  123456   2434
RBE2      625      2405  123456   2435
RBE2      626      2406  123456   2436
RBE2      627      2407  123456   2437
RBE2      628      2408  123456   2438
RBE2      629      2409  123456   2439
RBE2      630      2410  123456   2440
RBE2      631      2411  123456   2441
$
$ GRIDS AT 80% CHORD HINGE-LINE OF RIGHT SIDE VERTICAL TAIL
GRID      2601      0  430.110  525.500   77.500      0
GRID      2602      0  430.416  522.600   85.470      0
GRID      2603      0  430.722  519.700   93.440      0
GRID      2604      0  431.018  516.800  101.410      0
GRID      2605      0  431.324  513.900  109.380      0
GRID      2606      0  431.630  511.000  117.340      0
GRID      2607      0  431.926  508.100  125.310      0
GRID      2608      0  432.232  505.200  133.280      0
GRID      2609      0  432.538  502.300  141.250      0
GRID      2610      0  432.834  499.400  149.220      0
GRID      2611      0  433.140  496.500  157.190      0
$
$ *****
$ END OF RIGHT SIDE VERTICAL TAIL DEFINITION
$ *****
$
$ MAIN BEAMS FOR RIGHT WING
CBEAM      101      101      101      102      -1.      0.      0.
CBEAM      102      102      102      103      -1.      0.      0.
CBEAM      103      103      103      104      -1.      0.      0.
CBEAM      104      104      104      105      -1.      0.      0.
CBEAM      105      105      105      106      -1.      0.      0.

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CBEAM	106	106	106	107	-1.	0.	0.
CBEAM	107	107	107	108	-1.	0.	0.
CBEAM	108	108	108	109	-1.	0.	0.
CBEAM	109	109	109	110	-1.	0.	0.
CBEAM	110	110	110	111	-1.	0.	0.
CBEAM	111	111	111	112	-1.	0.	0.
CBEAM	112	112	112	113	-1.	0.	0.
CBEAM	113	113	113	114	-1.	0.	0.
CBEAM	114	114	114	115	-1.	0.	0.
CBEAM	115	115	115	116	-1.	0.	0.
CBEAM	116	116	116	117	-1.	0.	0.
CBEAM	117	117	117	118	-1.	0.	0.
CBEAM	118	118	118	119	-1.	0.	0.
CBEAM	119	119	119	120	-1.	0.	0.
CBEAM	120	120	120	121	-1.	0.	0.
CBEAM	121	121	121	122	-1.	0.	0.
CBEAM	122	122	122	123	-1.	0.	0.
CBEAM	123	123	123	124	-1.	0.	0.
CBEAM	124	124	124	125	-1.	0.	0.
CBEAM	125	125	125	126	-1.	0.	0.
CBEAM	126	126	126	127	-1.	0.	0.
CBEAM	127	127	127	128	-1.	0.	0.
CBEAM	128	128	128	129	-1.	0.	0.
CBEAM	129	129	129	130	-1.	0.	0.
CBEAM	130	130	130	131	-1.	0.	0.
CBEAM	131	131	131	132	-1.	0.	0.
CBEAM	132	132	132	133	-1.	0.	0.
CBEAM	133	133	133	134	-1.	0.	0.
CBEAM	134	134	134	135	-1.	0.	0.
CBEAM	135	135	135	136	-1.	0.	0.
CBEAM	136	136	136	137	-1.	0.	0.
CBEAM	137	137	137	138	-1.	0.	0.
CBEAM	138	138	138	139	-1.	0.	0.
CBEAM	139	139	139	140	-1.	0.	0.
CBEAM	140	140	140	141	-1.	0.	0.
\$ BEAMS FOR RIGHT WING TIP BOOM							
CBEAM	201	201	201	202	0.	1.	0.
CBEAM	202	202	202	203	0.	1.	0.
CBEAM	203	203	203	204	0.	1.	0.
CBEAM	204	204	204	205	0.	1.	0.
CBEAM	205	205	205	206	0.	1.	0.
CBEAM	206	206	206	207	0.	1.	0.
CBEAM	207	207	207	208	0.	1.	0.
CBEAM	208	208	208	209	0.	1.	0.
CBEAM	209	209	209	210	0.	1.	0.
CBEAM	210	210	210	211	0.	1.	0.
CBEAM	211	211	211	212	0.	1.	0.
CBEAM	212	212	212	213	0.	1.	0.
CBEAM	213	213	213	214	0.	1.	0.
CBEAM	214	214	214	215	0.	1.	0.
CBEAM	215	215	215	216	0.	1.	0.
CBEAM	216	216	216	217	0.	1.	0.
CBEAM	217	217	217	218	0.	1.	0.
CBEAM	218	218	218	219	0.	1.	0.
CBEAM	219	219	219	220	0.	1.	0.
CBEAM	220	220	220	221	0.	1.	0.
CBEAM	221	221	221	222	0.	1.	0.
CBEAM	222	222	222	223	0.	1.	0.
CBEAM	223	223	223	224	0.	1.	0.
CBEAM	224	224	224	225	0.	1.	0.
CBEAM	225	225	225	226	0.	1.	0.
CBEAM	226	226	226	227	0.	1.	0.
CBEAM	227	227	227	228	0.	1.	0.

CBEAM	228	228	228	229	0.	1.	0.
CBEAM	229	229	229	230	0.	1.	0.
CBEAM	230	230	230	231	0.	1.	0.
CBEAM	231	231	231	232	0.	1.	0.
CBEAM	232	232	232	233	0.	1.	0.
CBEAM	233	233	233	234	0.	1.	0.
CBEAM	234	234	234	235	0.	1.	0.
CBEAM	235	235	235	236	0.	1.	0.
CBEAM	236	236	236	237	0.	1.	0.
CBEAM	237	237	237	238	0.	1.	0.
CBEAM	238	238	238	239	0.	1.	0.
CBEAM	239	239	239	240	0.	1.	0.
CBEAM	240	240	240	241	0.	1.	0.
CBEAM	241	241	241	242	0.	1.	0.
CBEAM	242	242	242	243	0.	1.	0.

\$ RIGHT SIDE HORIZONTAL TAIL BEAMS

CBEAM	301	301	301	302	-1.	0.	0.
CBEAM	302	302	302	303	-1.	0.	0.
CBEAM	303	303	303	304	-1.	0.	0.
CBEAM	304	304	304	305	-1.	0.	0.
CBEAM	305	305	305	306	-1.	0.	0.
CBEAM	306	306	306	307	-1.	0.	0.
CBEAM	307	307	307	308	-1.	0.	0.
CBEAM	308	308	308	309	-1.	0.	0.
CBEAM	309	309	309	310	-1.	0.	0.
CBEAM	310	310	310	311	-1.	0.	0.

\$ RIGHT SIDE VERTICAL TAIL BEAMS

CBEAM	401	401	401	402	1.	0.	0.
CBEAM	402	402	402	403	1.	0.	0.
CBEAM	403	403	403	404	1.	0.	0.
CBEAM	404	404	404	405	1.	0.	0.
CBEAM	405	405	405	406	1.	0.	0.
CBEAM	406	406	406	407	1.	0.	0.
CBEAM	407	407	407	408	1.	0.	0.
CBEAM	408	408	408	409	1.	0.	0.
CBEAM	409	409	409	410	1.	0.	0.
CBEAM	410	410	410	411	1.	0.	0.

\$

\$ BEAM PROPERTIES FOR RIGHT WING ELASTIC AXIS

PBEAM	101	1	1000.	1021.	247.3	0.	174.3	0.
PBEAM	102	1	1000.	1005.	227.7	0.	171.5	0.
PBEAM	103	1	1000.	989.3	208.8	0.	168.7	0.
PBEAM	104	1	1000.	974.	190.5	0.	166.	0.
PBEAM	105	1	1000.	958.7	173.	0.	163.3	0.
PBEAM	106	1	1000.	943.7	156.2	0.	160.6	0.
PBEAM	107	1	1000.	928.8	140.2	0.	157.9	0.
PBEAM	108	1	1000.	914.	124.8	0.	155.3	0.
PBEAM	109	1	1000.	899.4	110.3	0.	152.7	0.
PBEAM	110	1	1000.	885.	96.95	0.	150.1	0.
PBEAM	111	1	1000.	870.7	92.06	0.	147.6	0.
PBEAM	112	1	1000.	856.6	86.48	0.	145.1	0.
PBEAM	113	1	1000.	842.6	79.99	0.	142.6	0.
PBEAM	114	1	1000.	828.8	75.44	0.	140.1	0.
PBEAM	115	1	1000.	815.2	71.21	0.	137.7	0.
PBEAM	116	1	1000.	801.6	68.65	0.	135.3	0.
PBEAM	117	1	1000.	788.3	67.96	0.	133.	0.
PBEAM	118	1	1000.	769.7	66.91	0.	129.7	0.
PBEAM	119	1	1000.	746.1	65.52	0.	125.5	0.
PBEAM	120	1	1000.	723.1	64.11	0.	121.4	0.
PBEAM	121	1	1000.	700.5	62.75	0.	117.4	0.
PBEAM	122	1	1000.	678.4	61.39	0.	113.5	0.
PBEAM	123	1	1000.	656.7	60.02	0.	109.7	0.
PBEAM	124	1	1000.	635.5	58.67	0.	106.	0.

PBEAM	125	1	1000.	614.8	57.33	0.	102.3	0.
PBEAM	126	1	1000.	594.6	56.01	0.	98.78	0.
PBEAM	127	1	1000.	574.8	54.7	0.	95.3	0.
PBEAM	128	1	1000.	555.4	53.4	0.	91.91	0.
PBEAM	129	1	1000.	536.5	52.12	0.	88.6	0.
PBEAM	130	1	1000.	518.	50.86	0.	85.37	0.
PBEAM	131	1	1000.	499.9	49.61	0.	82.22	0.
PBEAM	132	1	1000.	482.3	48.37	0.	79.15	0.
PBEAM	133	1	1000.	465.1	47.15	0.	76.15	0.
PBEAM	134	1	1000.	448.3	45.95	0.	73.23	0.
PBEAM	135	1	1000.	431.9	44.76	0.	70.39	0.
PBEAM	136	1	1000.	415.9	43.58	0.	67.62	0.
PBEAM	137	1	1000.	400.3	42.42	0.	64.93	0.
PBEAM	138	1	1000.	385.1	41.27	0.	62.3	0.
PBEAM	139	1	1000.	370.3	40.14	0.	59.75	0.
PBEAM	140	1	1000.	355.9	39.03	0.	57.27	0.

\$ BEAM PROPERTIES FOR RIGHT WING TIP BOOM

PBEAM	201	2	1000.	83.46	90.29	0.	238.6	0.
PBEAM	202	2	1000.	132.9	146.5	0.	238.6	0.
PBEAM	203	2	1000.	182.3	202.8	0.	238.6	0.
PBEAM	204	2	1000.	231.8	259.1	0.	238.6	0.
PBEAM	205	2	1000.	281.2	315.3	0.	238.6	0.
PBEAM	206	2	1000.	330.7	371.6	0.	238.6	0.
PBEAM	207	2	1000.	380.1	427.8	0.	238.6	0.
PBEAM	208	2	1000.	429.5	484.1	0.	238.6	0.
PBEAM	209	2	1000.	479.	540.4	0.	238.6	0.
PBEAM	210	2	1000.	528.4	596.6	0.	238.6	0.
PBEAM	211	2	1000.	577.8	652.9	0.	238.6	0.
PBEAM	212	2	1000.	627.3	709.1	0.	238.6	0.
PBEAM	213	2	1000.	676.7	765.4	0.	238.6	0.
PBEAM	214	2	1000.	726.2	821.7	0.	238.6	0.
PBEAM	215	2	1000.	704.4	793.9	0.	238.6	0.
PBEAM	216	2	1000.	682.7	766.2	0.	238.6	0.
PBEAM	217	2	1000.	661.	738.4	0.	238.6	0.
PBEAM	218	2	1000.	639.3	710.7	0.	238.6	0.
PBEAM	219	2	1000.	597.	659.8	0.	221.1	0.
PBEAM	220	2	1000.	556.2	610.7	0.	204.5	0.
PBEAM	221	2	1000.	516.7	563.3	0.	188.8	0.
PBEAM	222	2	1000.	478.6	517.7	0.	173.9	0.
PBEAM	223	2	1000.	441.9	473.7	0.	159.8	0.
PBEAM	224	2	1000.	406.6	431.5	0.	146.5	0.
PBEAM	225	2	1000.	372.6	391.1	0.	134.	0.
PBEAM	226	2	1000.	340.	352.3	0.	122.1	0.
PBEAM	227	2	1000.	308.8	315.3	0.	111.	0.
PBEAM	228	2	1000.	278.9	279.9	0.	100.6	0.
PBEAM	229	2	1000.	253.6	249.5	0.	113.6	0.
PBEAM	230	2	1000.	226.1	217.3	0.	102.3	0.
PBEAM	231	2	1000.	200.	186.8	0.	91.71	0.
PBEAM	232	2	1000.	177.6	160.2	0.	98.27	0.
PBEAM	233	2	1000.	153.9	132.9	0.	87.36	0.
PBEAM	234	2	1000.	131.7	107.3	0.	77.29	0.
PBEAM	235	2	1000.	112.4	85.01	0.	79.37	0.
PBEAM	236	2	1000.	94.08	64.02	0.	79.38	0.
PBEAM	237	2	1000.	75.6	43.23	0.	69.04	0.
PBEAM	238	2	1000.	59.53	25.2	0.	67.1	0.
PBEAM	239	2	1000.	44.55	8.614	0.	63.92	0.
PBEAM	240	2	1000.	30.7	8.007	0.	59.78	0.
PBEAM	241	2	1000.	14.37	3.655	0.	27.47	0.
PBEAM	242	2	1000.	3.024	3.024	0.	22.9	0.

\$ BEAM PROPERTIES FOR RIGHT SIDE HORIZONTAL TAIL

PBEAM	301	3	1000.	1047.	54.91	0.	179.	0.
PBEAM	302	3	1000.	894.1	41.7	0.	151.7	0.
PBEAM	303	3	1000.	756.8	30.83	0.	127.4	0.

PBEAM	304	3	1000.	634.3	22.05	0.	105.8	0.
PBEAM	305	3	1000.	525.8	15.11	0.	86.74	0.
PBEAM	306	3	1000.	430.5	9.772	0.	70.15	0.
PBEAM	307	3	1000.	347.4	5.823	0.	55.82	0.
PBEAM	308	3	1000.	275.8	3.046	0.	43.59	0.
PBEAM	309	3	1000.	214.8	1.241	0.	33.28	0.
PBEAM	310	3	1000.	163.5	0.2188	0.	24.75	0.
\$ BEAM PROPERTIES FOR RIGHT SIDE VERTICAL TAIL								
PBEAM	401	4	1000.	542.6	24.42	0.	73.63	0.
PBEAM	402	4	1000.	486.7	18.52	0.	66.03	0.
PBEAM	403	4	1000.	434.7	13.68	0.	58.98	0.
PBEAM	404	4	1000.	386.6	9.785	0.	52.45	0.
PBEAM	405	4	1000.	342.1	6.712	0.	46.42	0.
PBEAM	406	4	1000.	301.3	4.35	0.	40.87	0.
PBEAM	407	4	1000.	263.8	2.599	0.	35.79	0.
PBEAM	408	4	1000.	229.5	1.365	0.	31.14	0.
PBEAM	409	4	1000.	198.4	0.5584	0.	26.91	0.
PBEAM	410	4	1000.	170.2	0.09922	0.	23.09	0.
\$								
\$ MATERIAL PROPERTIES								
\$ FEMAP Material 1 : Generic - WING AND CHORDWISE SPINES								
MAT1	11000000.1000000.	0.3	0.	0.	0.	0.		
\$								
\$ FEMAP Material 1 : Generic - BOOM								
MAT1	21000000.1000000.	0.3	0.	0.	0.	0.		
\$								
\$ FEMAP Material 1 : Generic - HORIZONTAL								
MAT1	31000000.1000000.	0.3	0.	0.	0.	0.		
\$								
\$ FEMAP Material 1 : Generic - VERTICAL								
MAT1	41000000.1000000.	0.3	0.	0.	0.	0.		
\$								
\$ LUMPED MASSES								
\$ Fuselage Rigid Body Mass (50% for 1/2 symm model)								
\$								
CONM2	601	100	-1	446.1	125.80	0.00	86.1	0 MASS601
+MASS601	2.64E5	0	8.90E5	0	0	6.95E5		
\$								
\$ *****								
\$ LUMPED MASSES FOR RIGHT-WING								
\$ *****								
\$ RIGHT WING								
CONM2	602	102	-1	7.91	157.54	6.57	49.16	0 MASS602
CONM2	603	103	-1	7.75	157.67	19.72	49.83	0 MASS603
CONM2	604	104	-1	7.60	157.80	32.87	50.50	0 MASS604
CONM2	605	105	-1	7.45	157.92	46.01	51.17	0 MASS605
CONM2	606	106	-1	7.30	158.05	59.16	51.84	0 MASS606
CONM2	607	107	-1	7.16	158.17	72.31	52.51	0 MASS607
CONM2	608	108	-1	7.03	158.30	85.46	53.17	0 MASS608
CONM2	609	109	-1	6.90	158.42	98.60	53.84	0 MASS609
CONM2	610	110	-1	6.77	158.54	111.75	54.51	0 MASS610
CONM2	611	111	-1	6.66	158.65	124.90	55.18	0 MASS611
CONM2	612	112	-1	6.57	158.71	138.04	55.86	0 MASS612
CONM2	613	113	-1	6.49	158.77	151.19	56.54	0 MASS613
CONM2	614	114	-1	6.41	158.82	164.34	57.22	0 MASS614
CONM2	615	115	-1	6.35	158.83	177.49	57.91	0 MASS615
CONM2	616	116	-1	6.30	158.82	190.63	58.60	0 MASS616
CONM2	617	117	-1	6.26	158.79	203.78	59.29	0 MASS617
CONM2	618	118	-1	6.24	158.74	216.93	59.99	0 MASS618
CONM2	619	119	-1	6.19	158.66	230.07	60.69	0 MASS619
\$								
+MASS602	114.0	0	2357.1	0	0	2471.1		
+MASS603	111.7	0	2285.6	0	0	2397.2		

+MASS604	109.4	0	2216.7	0	0	2326.1		
+MASS605	107.3	0	2150.3	0	0	2257.6		
+MASS606	105.2	0	2086.5	0	0	2191.6		
+MASS607	103.2	0	2025.0	0	0	2128.2		
+MASS608	101.2	0	1966.0	0	0	2067.2		
+MASS609	99.4	0	1909.2	0	0	2008.6		
+MASS610	97.6	0	1854.7	0	0	1952.3		
+MASS611	95.9	0	1802.8	0	0	1898.7		
+MASS612	94.6	0	1760.2	0	0	1854.9		
+MASS613	93.4	0	1719.1	0	0	1812.6		
+MASS614	92.3	0	1679.5	0	0	1771.8		
+MASS615	91.5	0	1646.6	0	0	1738.0		
+MASS616	90.7	0	1615.4	0	0	1706.1		
+MASS617	90.2	0	1587.8	0	0	1678.0		
+MASS618	89.8	0	1563.6	0	0	1653.4		
+MASS619	88.9	0	1527.9	0	0	1616.9		
\$								

\$ BEGIN FUEL STATIONS								

\$								
\$ No Fuel								
\$								
\$CONM2	620	120	-1	6.14	158.56	243.20	61.53	0 MASS620
\$CONM2	621	121	-1	6.10	158.46	256.33	62.23	0 MASS621
\$CONM2	622	122	-1	6.05	158.36	269.46	62.93	0 MASS622
\$CONM2	623	123	-1	6.00	158.26	282.59	63.63	0 MASS623
\$CONM2	624	124	-1	5.95	158.16	295.72	64.33	0 MASS624
\$CONM2	625	125	-1	5.91	158.06	308.85	65.03	0 MASS625
\$CONM2	626	126	-1	5.86	157.96	321.98	65.73	0 MASS626
\$								
\$ No Fuel								
\$								
+\$MASS620	88.3	0	1485.1	0	0	1573.4		
+\$MASS621	87.6	0	1443.1	0	0	1530.7		
+\$MASS622	86.9	0	1402.0	0	0	1488.9		
+\$MASS623	86.2	0	1361.5	0	0	1447.8		
+\$MASS624	85.5	0	1321.9	0	0	1407.5		
+\$MASS625	84.9	0	1283.1	0	0	1367.9		
+\$MASS626	84.2	0	1245.0	0	0	1329.1		
\$								
\$ WITH FUEL AT AN ALTITUDE OF 1000 FEET (10/15/98)								
\$								
CONM2	620	120	-1	25.379	157.65	243.20	61.53	0 MASS620
CONM2	621	121	-1	24.861	157.57	256.33	62.23	0 MASS621
CONM2	622	122	-1	24.348	157.49	269.46	62.93	0 MASS622
CONM2	623	123	-1	23.839	157.41	282.59	63.63	0 MASS623
CONM2	624	124	-1	23.335	157.33	295.72	64.33	0 MASS624
CONM2	625	125	-1	22.839	157.25	308.85	65.03	0 MASS625
CONM2	626	126	-1	22.348	157.17	321.98	65.73	0 MASS626
\$								
\$ WITH FUEL AT AN ALTITUDE OF 1000 FEET (10/15/98)								
\$								
+MASS620	364.62	0	3931.34	0	0	4090.73		
+MASS621	357.16	0	3774.54	0	0	3930.40		
+MASS622	349.80	0	3622.52	0	0	3774.90		
+MASS623	342.48	0	3475.13	0	0	3624.12		
+MASS624	335.29	0	3332.35	0	0	3477.95		
+MASS625	328.15	0	3194.03	0	0	3336.28		
+MASS626	321.10	0	3060.12	0	0	3199.03		
\$								
\$ With Fuel								
\$								

\$ CONM2	620	120	-1	56.86	157.65	243.20	61.53	0 MASS620
\$ CONM2	621	121	-1	55.70	157.57	256.33	62.23	0 MASS621
\$ CONM2	622	122	-1	54.55	157.49	269.46	62.93	0 MASS622
\$ CONM2	623	123	-1	53.41	157.41	282.59	63.63	0 MASS623
\$ CONM2	624	124	-1	52.28	157.33	295.72	64.33	0 MASS624
\$ CONM2	625	125	-1	51.17	157.25	308.85	65.03	0 MASS625
\$ CONM2	626	126	-1	50.07	157.17	321.98	65.73	0 MASS626

\$

\$ With Fuel

\$

\$ +MASS620	816.9	0	8807.9	0	0	9165.0	
\$ +MASS621	800.2	0	8456.6	0	0	8805.8	
\$ +MASS622	783.7	0	8116.0	0	0	8457.4	
\$ +MASS623	767.3	0	7785.8	0	0	8119.6	
\$ +MASS624	751.2	0	7465.9	0	0	7792.1	
\$ +MASS625	735.2	0	7156.0	0	0	7474.7	
\$ +MASS626	719.4	0	6856.0	0	0	7167.2	

\$

END FUEL STATIONS

\$

CONM2	627	127	-1	5.81	157.86	335.11	66.31	0 MASS627
CONM2	628	128	-1	5.76	157.76	348.24	67.01	0 MASS628
CONM2	629	129	-1	5.72	157.66	361.37	67.71	0 MASS629
CONM2	630	130	-1	5.67	157.56	374.50	68.42	0 MASS630
CONM2	631	131	-1	5.62	157.46	387.63	69.12	0 MASS631
CONM2	632	132	-1	5.58	157.37	400.76	69.82	0 MASS632
CONM2	633	133	-1	5.53	157.27	413.89	70.52	0 MASS633
CONM2	634	134	-1	5.48	157.17	427.02	71.23	0 MASS634
CONM2	635	135	-1	5.43	157.07	440.15	71.93	0 MASS635
CONM2	636	136	-1	12.39	155.86	453.28	72.81	0 MASS636
CONM2	637	137	-1	5.34	156.87	466.41	73.33	0 MASS637
CONM2	638	138	-1	12.29	155.76	479.54	74.19	0 MASS638
CONM2	639	139	-1	5.24	156.67	492.67	74.74	0 MASS639
CONM2	640	140	-1	12.20	155.67	505.80	75.58	0 MASS640
CONM2	641	141	-1	5.15	156.47	518.93	76.14	0 MASS641

\$

+MASS627	83.5	0	1207.6	0	0	1291.1	
+MASS628	82.8	0	1171.0	0	0	1253.8	
+MASS629	82.1	0	1135.2	0	0	1217.3	
+MASS630	81.5	0	1100.0	0	0	1181.5	
+MASS631	80.8	0	1065.6	0	0	1146.4	
+MASS632	80.1	0	1031.9	0	0	1112.0	
+MASS633	79.4	0	999.0	0	0	1078.4	
+MASS634	78.7	0	966.7	0	0	1045.4	
+MASS635	78.1	0	935.1	0	0	1013.2	
+MASS636	77.4	0	974.4	0	0	974.4	
+MASS637	76.7	0	874.0	0	0	950.7	
+MASS638	76.0	0	912.3	0	0	912.3	
+MASS639	75.3	0	815.6	0	0	890.9	
+MASS640	74.7	0	853.1	0	0	853.1	
+MASS641	74.0	0	759.8	0	0	833.8	

\$

\$ LUMPED MASSES ON RIGHT WING-TIP BOOM

CONM2	702	202	-1	11.25	33.61	525.50	77.50	0 MASS702
CONM2	703	203	-1	16.33	42.22	525.50	77.50	0 MASS703
CONM2	704	204	-1	16.41	50.83	525.50	77.50	0 MASS704
CONM2	705	205	-1	11.48	59.44	525.50	77.50	0 MASS705
CONM2	706	206	-1	1.56	68.06	525.50	77.50	0 MASS706
CONM2	707	207	-1	1.64	76.67	525.50	77.50	0 MASS707
CONM2	708	208	-1	1.72	85.28	525.50	77.50	0 MASS708
CONM2	709	209	-1	1.79	93.89	525.50	77.50	0 MASS709

CONM2	710	210	-1	1.87	102.50	525.50	77.50	0 MASS710
CONM2	711	211	-1	1.95	111.11	525.50	77.50	0 MASS711
CONM2	712	212	-1	2.02	119.72	525.50	77.50	0 MASS712
CONM2	713	213	-1	2.10	128.33	525.50	77.50	0 MASS713
CONM2	714	214	-1	2.18	136.94	525.50	77.50	0 MASS714
CONM2	715	215	-1	2.25	145.56	525.50	77.50	0 MASS715
CONM2	716	216	-1	2.22	154.17	525.50	77.50	0 MASS716
CONM2	717	217	-1	2.18	162.78	525.50	77.50	0 MASS717
CONM2	718	218	-1	5.65	171.39	525.50	77.50	0 MASS718
CONM2	719	219	-1	2.11	180.00	525.50	77.50	0 MASS719
CONM2	720	220	-1	2.41	190.00	525.50	77.50	0 MASS720
CONM2	721	221	-1	2.35	200.00	525.50	77.50	0 MASS721
CONM2	722	222	-1	2.30	210.00	525.50	77.50	0 MASS722
CONM2	723	223	-1	2.24	220.00	525.50	77.50	0 MASS723
CONM2	724	224	-1	2.17	230.00	525.50	77.50	0 MASS724
CONM2	725	225	-1	2.11	240.00	525.50	77.50	0 MASS725
CONM2	726	226	-1	2.05	250.00	525.50	77.50	0 MASS726
CONM2	727	227	-1	1.98	260.00	525.50	77.50	0 MASS727
CONM2	728	228	-1	1.91	270.00	525.50	77.50	0 MASS728
CONM2	729	229	-1	1.84	280.00	525.50	77.50	0 MASS729
CONM2	730	230	-1	1.89	290.00	525.50	77.50	0 MASS730
CONM2	731	231	-1	1.81	300.00	525.50	77.50	0 MASS731
CONM2	732	232	-1	1.73	310.00	525.50	77.50	0 MASS732
CONM2	733	233	-1	1.76	320.00	525.50	77.50	0 MASS733
CONM2	734	234	-1	1.66	330.00	525.50	77.50	0 MASS734
CONM2	735	235	-1	1.56	340.00	525.50	77.50	0 MASS735
CONM2	736	236	-1	1.56	350.00	525.50	77.50	0 MASS736
CONM2	737	237	-1	1.54	360.00	525.50	77.50	0 MASS737
CONM2	738	238	-1	1.42	370.00	525.50	77.50	0 MASS738
CONM2	739	239	-1	1.37	380.00	525.50	77.50	0 MASS739
CONM2	740	240	-1	1.31	390.00	525.50	77.50	0 MASS740
CONM2	741	241	-1	1.29	400.00	525.50	77.50	0 MASS741
CONM2	742	242	-1	0.80	410.00	525.50	77.50	0 MASS742
CONM2	743	243	-1	0.71	420.00	525.50	77.50	0 MASS743

\$

\$

+MASS702	316.5	0	126.6	0	0	126.6
+MASS703	459.3	0	330.6	0	0	330.6
+MASS704	461.5	0	332.1	0	0	332.1
+MASS705	323.0	0	232.5	0	0	232.5
+MASS706	87.8	0	53.6	0	0	53.6
+MASS707	92.2	0	56.2	0	0	56.2
+MASS708	96.5	0	58.8	0	0	58.8
+MASS709	100.8	0	61.5	0	0	61.5
+MASS710	105.1	0	64.1	0	0	64.1
+MASS711	109.5	0	66.8	0	0	66.8
+MASS712	113.8	0	69.4	0	0	69.4
+MASS713	118.1	0	72.0	0	0	72.0
+MASS714	122.5	0	74.7	0	0	74.7
+MASS715	126.8	0	77.3	0	0	77.3
+MASS716	124.8	0	76.1	0	0	76.1
+MASS717	122.7	0	74.9	0	0	74.9
+MASS718	158.8	0	114.3	0	0	114.3
+MASS719	118.7	0	72.4	0	0	72.4
+MASS720	128.9	0	84.6	0	0	84.6
+MASS721	119.5	0	79.4	0	0	79.4
+MASS722	110.5	0	74.4	0	0	74.4
+MASS723	101.8	0	69.6	0	0	69.6
+MASS724	93.6	0	64.9	0	0	64.9
+MASS725	85.8	0	60.5	0	0	60.5
+MASS726	78.3	0	56.2	0	0	56.2
+MASS727	71.3	0	52.1	0	0	52.1
+MASS728	64.5	0	48.2	0	0	48.2

+MASS729	58.2	0	44.4	0	0	44.4
+MASS730	56.0	0	43.8	0	0	43.8
+MASS731	50.0	0	40.1	0	0	40.1
+MASS732	44.3	0	36.6	0	0	36.6
+MASS733	41.8	0	35.5	0	0	35.5
+MASS734	36.5	0	32.1	0	0	32.1
+MASS735	31.6	0	28.8	0	0	28.8
+MASS736	29.0	0	27.5	0	0	27.5
+MASS737	26.2	0	26.0	0	0	26.0
+MASS738	21.9	0	22.8	0	0	22.8
+MASS739	19.3	0	21.1	0	0	21.1
+MASS740	16.6	0	19.2	0	0	19.2
+MASS741	14.7	0	18.1	0	0	18.1
+MASS742	8.1	0	10.7	0	0	10.7
+MASS743	6.4	0	9.1	0	0	9.1

\$ LUMPED MASSES FOR RIGHT SIDE HORIZONTAL TAIL

CONM2	802	302	-1	4.97	387.10	530.25	77.80	0 MASS802
CONM2	803	303	-1	4.73	386.66	539.75	79.47	0 MASS803
CONM2	804	304	-1	7.69	387.79	549.25	81.06	0 MASS804
CONM2	805	305	-1	4.26	385.75	558.75	82.82	0 MASS805
CONM2	806	306	-1	4.03	385.29	568.25	84.49	0 MASS806
CONM2	807	307	-1	7.00	387.18	577.75	86.04	0 MASS807
CONM2	808	308	-1	3.58	384.33	587.25	87.84	0 MASS808
CONM2	809	309	-1	3.35	383.83	596.75	89.51	0 MASS809
CONM2	810	310	-1	6.34	386.70	606.25	91.01	0 MASS810
CONM2	811	311	-1	2.92	382.81	615.75	92.87	0 MASS811

\$

+MASS802	37.4	0	1504.7	0	0	1542.1
+MASS803	35.6	0	1289.2	0	0	1324.7
+MASS804	33.8	0	1149.5	0	0	1149.5
+MASS805	32.0	0	923.6	0	0	955.6
+MASS806	30.3	0	770.9	0	0	801.2
+MASS807	28.6	0	710.0	0	0	710.0
+MASS808	26.9	0	519.2	0	0	546.1
+MASS809	25.2	0	417.6	0	0	442.8
+MASS810	23.6	0	427.7	0	0	427.7
+MASS811	22.0	0	256.7	0	0	278.7

\$ LUMPED MASSES FOR RIGHT SIDE VERTICAL TAIL

CONM2	902	402	-1	3.06	413.63	524.05	81.48	0 MASS902
CONM2	903	403	-1	2.91	414.65	521.15	89.45	0 MASS903
CONM2	904	404	-1	5.97	418.34	518.25	97.42	0 MASS904
CONM2	905	405	-1	2.63	416.67	515.35	105.39	0 MASS905
CONM2	906	406	-1	2.49	417.67	512.45	113.36	0 MASS906
CONM2	907	407	-1	2.36	418.66	509.55	121.33	0 MASS907
CONM2	908	408	-1	5.43	422.59	506.65	129.30	0 MASS908
CONM2	909	409	-1	2.1	420.61	503.75	137.27	0 MASS909
CONM2	910	410	-1	1.98	421.57	500.85	145.23	0 MASS910
CONM2	911	411	-1	1.86	422.50	497.95	153.20	0 MASS911

\$

+MASS902	18.3	0	616.3	0	0	597.9
+MASS903	17.5	0	547.1	0	0	529.7
+MASS904	16.6	0	483.7	0	0	467.1
+MASS905	15.8	0	425.8	0	0	410.0
+MASS906	14.9	0	373.1	0	0	358.2
+MASS907	14.1	0	325.3	0	0	311.2
+MASS908	13.3	0	282.3	0	0	269.0
+MASS909	12.6	0	243.7	0	0	231.1
+MASS910	11.8	0	209.3	0	0	197.5
+MASS911	11.1	0	178.9	0	0	167.8

\$

PBEAM	2301	1	100.	1000.	1000.	0.	1000.
PBEAM	2401	1	100.	1000.	1000.	0.	1000.

\$

\$ RIGHT SIDE BEAMS FROM H-TAIL MAIN BEAM TO HINGE LINE

CBEAM	2301	2301	301	2501	302
CBEAM	2302	2301	302	2502	301
CBEAM	2303	2301	303	2503	301
CBEAM	2304	2301	304	2504	301
CBEAM	2305	2301	305	2505	301
CBEAM	2306	2301	306	2506	301
CBEAM	2307	2301	307	2507	301
CBEAM	2308	2301	308	2508	301
CBEAM	2309	2301	309	2509	301
CBEAM	2310	2301	310	2510	301
CBEAM	2311	2301	311	2511	301

\$

\$ RIGHT SIDE BEAMS FROM H-TAIL HINGE LINE TO H-TAIL TRAILING EDGE

CBEAM	2321	2301	2501	2301	2502
CBEAM	2322	2301	2502	2302	2501
CBEAM	2323	2301	2503	2303	2501
CBEAM	2324	2301	2504	2304	2501
CBEAM	2325	2301	2505	2305	2501
CBEAM	2326	2301	2506	2306	2501
CBEAM	2327	2301	2507	2307	2501
CBEAM	2328	2301	2508	2308	2501
CBEAM	2329	2301	2509	2309	2501
CBEAM	2330	2301	2510	2310	2501
CBEAM	2331	2301	2511	2311	2501

\$

\$ RIGHT SIDE BEAMS FROM V-TAIL MAIN BEAM TO HINGE LINE

CBEAM	2401	2401	401	2601	402
CBEAM	2402	2401	402	2602	401
CBEAM	2403	2401	403	2603	401
CBEAM	2404	2401	404	2604	401
CBEAM	2405	2401	405	2605	401
CBEAM	2406	2401	406	2606	401
CBEAM	2407	2401	407	2607	401
CBEAM	2408	2401	408	2608	401
CBEAM	2409	2401	409	2609	401
CBEAM	2410	2401	410	2610	401
CBEAM	2411	2401	411	2611	401

\$

\$ RIGHT SIDE BEAMS FROM V-TAIL HINGE LINE TO V-TAIL TRAILING EDGE

CBEAM	2421	2401	2601	2401	2602
CBEAM	2422	2401	2602	2402	2601
CBEAM	2423	2401	2603	2403	2601
CBEAM	2424	2401	2604	2404	2601
CBEAM	2425	2401	2605	2405	2601
CBEAM	2426	2401	2606	2406	2601
CBEAM	2427	2401	2607	2407	2601
CBEAM	2428	2401	2608	2408	2601
CBEAM	2429	2401	2609	2409	2601
CBEAM	2430	2401	2610	2410	2601
CBEAM	2431	2401	2611	2411	2601

\$

ENDDAT

```

GRID, 30, 0, 379.75, 521.5678, 100.0 $  DEFINES DIRECTION OF Z-AXIS (H-
TAIL)
GRID, 40, 0, 410.39, 587.3362, 100.0 $  DEFINES DIRECTION OF Z-AXIS (V-
TAIL)
$
$  COORDINATE SYSTEM 12 IS A REFERENCE AXIS SYSTEM FOR STABILITY DERIVATIVES
CORD2R      12      0 156.51      0.0  48.98  156.51      0.0   40.0 +CO12
+CO12      140.0  0.0      48.98
$  LOCAL COORD. SYSTEM FOR HORIZONTAL TAIL
CORD1R, 5, 301, 30, 2301 $  Z-AXIS NORMAL TO PLANE OF HORIZ. TAIL
$  LOCAL COORD. SYSTEM FOR VERTICAL TAIL
CORD1R, 6, 401, 40, 2401 $  Z-AXIS NORMAL TO PLANE OF VERT. TAIL
$
$  LOCAL COORDINATE SYSTEM TO DEFINE Y-AXIS OF RIGHT H-TAIL HINGE LINE
CORD2R      13      0 404.480 525.50  77.360  404.480 521.5678 100.0 +CO13
+CO13      450.0531.888378.46955
$  LOCAL COORDINATE SYSTEM TO DEFINE Y-AXIS OF RIGHT V-TAIL HINGE LINE
CORD2R      14      0 433.14  496.50 157.190  433.14 0614.1537 200.0 +CO14
+CO14      500.0497.3168154.9451
$
$  SELECT THE DESIRED BOUNDARY CONDITIONS
$  Fixed Root
$  SPC      1      101 123456      0.
$
$  Symmetric BC *  CONSTRAIN GRIDS ON CENTERLINE
SPC      1      101      246      0.0      95      246      0.0
$
$  Antisymmetric BC
$  SPC      1      101 135      0.
$
$  *****
$  SECTION FOR DYNAMIC RESPONSE TO GUST LOADING
$  *****
$
PARAM, MACH, 0.090 $  DESIRED MACH NUMBER
PARAM, Q, 0.077444 $  DYNAMIC PRESSURE IN PSI AT 1000 FT. (V=1179.6 IN/SEC)
PARAM, GUSTAERO, -1
$
$  STRUCTURAL MODAL DAMPING = 0.02 IN EACH MODE
TABDMP1      25      G
+TDMP1
+TDMP1      0.0      0.02      60.0      0.02      ENDT
$
$  *****
$  FOLLOWING GROUP OF INPUT IS FOR THE VON KARMAN PSD
$
$RANDPS      111      1      1      1.0      0.0      121
$  VON KARMAN GUST WITH (L/U)=10.1729 SEC., AND WG=1.0 IN/SEC
$TABRNDG      121      1 10.1729      1.0
$  VELOCITY ON 'GUST' MUST BE SAME AS ON 'AERO' INPUT RECORD.
$GUST      36      468.4774-4      0.0 1179.6
$  SID      DLOAD      WG      XO      V
$GUST      1000      2000      23.58      -472.      2360.
$      2      3      4      5      6      7      8      9      1
$2345678123456781234567812345678123456781234567812345678123456787
GUST      1180      2180      1.0      0.0 1179.6
GUST      1280      2280      1.0      0.0 1179.6

```


GUST	1380	2380	1.0	0.0	1179.6
GUST	1480	2480	1.0	0.0	1179.6
GUST	1580	2580	1.0	0.0	1179.6
GUST	1680	2680	1.0	0.0	1179.6
GUST	1780	2780	1.0	0.0	1179.6
GUST	1880	2880	1.0	0.0	1179.6

\$
 \$ TLOAD2 DEFINES A TIME DEPENDENT DYNAMIC LOAD OR ENFORCED MOTION.
 \$ LISTED ARE THE ID, DAREA ID, DELAY ID, TYPE OF DYNAMIC EXCITATION,
 \$ AND AN ANALYTICAL FUNCTION.
 \$

	2	3	4	5	6	7	8	9	1
\$	2345678	12345678	12345678	12345678	12345678	12345678	12345678	12345678	12345678
\$	SID	DAREA	DELAY	TYPE	T1	T2	F	P	
\$ 1d8									
tload2	1181	1002			.2	.335109	0.	0.	
	0.	0.							
tload2	1182	1002			.2	.335109	7.4014120.		
	0.	0.							
dload	2180	0.5	1.	1181	-1.	1182			
\$ 2d8									
tload2	1281	1002			.2	.470219	0.	0.	
	0.	0.							
tload2	1282	1002			.2	.470219	3.7007060.		
	0.	0.							
dload	2280	0.5	1.	1281	-1.	1282			
\$ 3d8									
tload2	1381	1002			.2	.603855	0.	0.	
	0.	0.							
tload2	1382	1002			.2	.603855	2.4671370.		
	0.	0.							
dload	2380	0.5	1.	1381	-1.	1382			
\$ 4d8									
tload2	1481	1002			.2	.740437	0.	0.	
	0.	0.							
tload2	1482	1002			.2	.740437	1.8503530.		
	0.	0.							
dload	2480	0.5	1.	1481	-1.	1482			
\$ 5d8									
tload2	1581	1002			.2	.875548	0.	0.	
	0.	0.							
tload2	1582	1002			.2	.875548	1.48028	0.	
	0.	0.							
dload	2580	0.5	1.	1581	-1.	1582			
\$ 6d8									
tload2	1681	1002			.2	1.01066	0.	0.	
	0.	0.							
tload2	1682	1002			.2	1.01066	1.23357	0.	
	0.	0.							
dload	2680	0.5	1.	1681	-1.	1682			
\$ 7d8									
tload2	1781	1002			.2	1.14577	0.	0.	
	0.	0.							
tload2	1782	1002			.2	1.14577	1.05734	0.	
	0.	0.							
dload	2780	0.5	1.	1781	-1.	1782			
\$ 8d8									

```

tload2 1881    1002          .2      1.28088 0.      0.
      0.      0.
tload2 1882    1002          .2      1.28088 .925176 0.
      0.      0.
dload  2880    0.5      1.      1881    -1.      1882
$
$RLOAD1          46      56          66
$  APPLY VON KARMAN GUST TO THE EPOINT FOR SUBSEQUENT OUTPUT
DAREA      1002    9990          1.0
EPOINT      9990
$  TABLED1 PROVIDES FREQUENCY INTERVAL OVER WHICH LOADS ARE GENERATED
$TABLED1      66
+TDVK1
$+TDVK1      0.0      1.0      60.0      1.0      ENDTA
$
$  TSTEP DEFINES TIME STEP INTERVALS AT WHICH THE TRANSIENT
$  RESPONSES ARE DESIRED.  LISTED ARE THE NUMBER OF STEPS,
$  THE TIME INTERVAL AND SKIP FACTOR FOR OUTPUT.
$  SID      N      DT      NO
TSTEP  41      800      .025      1
$
$  FREQ1 DEFINES THE SET OF FREQUENCIES USED TO OBTAIN
$  THE FREQUENCY RESPONSE SOLUTION.  LISTED ARE THE STARTING
$  FREQUENCY, FREQUENCY INCREMENT AND NUMBER OF INCREMENTS.
$  SID      F1      DF      NDF
$FREQ1  40      0.      .1      100
FREQ1      42      0.00      0.05      400
$
$  SETS OF FREQUENCIES USED IN SOLUTION OF FREQUENCY RESPONSE PROBLEMS
$FREQ1      41      0.0001      0.0001      9
$FREQ1      41      0.001      0.001      9
$FREQ1      41      0.010      0.010      9
$FREQ1      41      0.10      0.05      1198
$  DMIG DEFINES AN EPOINT USED TO OUTPUT THE VON KARMAN PSD
DMIG      STIFF      0      6      1      0
DMIG      STIFF      9990      0      9990      0      1.0
$
$  *****
$  END OF SECTION FOR DYNAMIC RESPONSE TO GUST LOADING
$  *****
$  *****
$  BEGIN AERODYNAMIC FLUTTER CARDS
$  *****
$  VALUE OF FIELD 6 (SYMxz) IS 1 FOR SYM CASE, -1 FOR ASYM, 0 FOR FIXED
$      2      3      4      5      6      7      8      9      1
$2345678123456781234567812345678123456781234567812345678123456787
$  AERO. DENSITY UNITS: LB-SEC**2/IN**4 (SEA-LEVEL)
AERO      0      1179.6      51.001.1463-7      1      0
$
$ Inboard Wing (RIGHT SIDE)
CAERO1 10001      1      0      17      8      1
+CA101
+CA101 132.83      0.0      48.98      59.2      134.33      223.5      60.77      54.03

```

\$
 \$GRID 101 0 156.51 0.00 48.98
 \$ (156.51-132.83)/59.2=0.40 chord
 \$
 \$ Outboard Wing (RIGHT SIDE)
 CAERO1 20001 1 0 23 8 1
 +CA102
 +CA102 134.33 223.5 60.77 54.03 138.03 525.5 76.79 41.28
 \$
 \$GRID 118 0 155.94 223.50 60.77
 \$ (155.94-134.33)/54.03=0.40 chord
 \$
 \$ RIGHT-SIDE HORIZONTAL TAIL
 \$ THE H-TAIL PANEL SPANS THE AREA FROM THE LEADING EDGE TO THE HINGE LINE
 CAERO1 30001 1 0 20 8 1
 +CA103
 +CA103 355.08 525.5 77.36 49.40 366.04 620.5 93.92 24.704
 \$
 \$ RIGHT-SIDE CONTROL SURFACE PANEL ON HORIZONTAL TAIL
 CAERO1 31001 1 0 20 2 1
 +CA103A
 +CA103A 404.480 525.50 77.360 12.35 390.744 620.50 93.920 6.176
 \$
 \$GRID 301 0 379.75 525.50 77.36
 \$ (379.75-355.08)/61.75=0.40 chord
 \$
 \$ RIGHT-SIDE VERTICAL TAIL
 \$ CAERO1 40001 1 0 16 8 1
 +CA104
 \$ +CA104 390.67 525.5 77.5 49.3 407.54 496.5 157.19 32.00
 \$
 \$ REDEFINE POINTS 1 AND 4 FOR VERTICAL TAIL (SWAP POINTS 1 AND 4)
 CAERO1 40001 1 0 20 8 1
 +CA104
 +CA104 407.54 496.5 157.19 25.60 390.67 525.5 77.5 39.44
 \$
 \$ RIGHT-SIDE CONTROL SURFACE PANEL ON VERTICAL TAIL
 CAERO1 41001 1 0 20 2 1
 +CA104A
 +CA104A 433.140 496.50 157.190 6.40 430.110 525.50 77.50 9.86
 \$
 \$GRID 401 0 410.39 525.50 77.50
 \$ (410.39-390.67)/49.30=0.40 chord
 \$
 \$ DENS MACH VEL INTERP MODES PK TOL (0.001
 default)
 FLUTTER 30 PK 1 2 4 L 10
 FLFACT 1 1.0
 FLFACT 2 0.0
 \$
 \$ FOR PK METHOD, 'FLFACT 4' IS A VELOCITY TABLE (UNITS IN/SEC)
 \$ A MINUS SIGN FOR A VELOCITY IS A REQUEST FOR EIGENVALUE OUTPUT
 FLFACT 4 176.0 528.0 880.0 1320.0 1760.0 2640.0 3520.0 +FL01
 +FL01 4400.0 5280.0 6200.0 7040.0
 \$
 \$ TABLES OF MACH NUMBER AND REDUCED FREQUENCY
 MKAERO1 0.09 +MK1

+MK1	0.00001	0.005	0.01	0.02	0.04	0.06	0.08	0.1	
MKAERO1	0.09								+MK2
+MK2	0.2	0.4	0.6	0.8	1.0	2.0	3.0	4.0	
MKAERO1	0.09								+MK3
+MK3	5.0	6.0	7.0	8.0	9.0	10.0			

\$

PAERO1 1

\$

\$ TEST USAGE OF SURFACE SPLINES ON ALL LIFTING SURFACES

\$ SPLINE1 = 100 RIGHT-SIDE INBOARD WING

\$ SPLINE1 = 200 RIGHT-SIDE OUTBOARD WING

\$ SPLINE1 = 300 RIGHT-SIDE HORIZONTAL TAIL WITHOUT CONTROL SURFACE

\$ SPLINE1 = 305 RIGHT-SIDE CONTROL SURFACE ON HORIZONTAL TAIL

\$ SPLINE1 = 400 RIGHT-SIDE VERTICAL TAIL WITHOUT CONTROL SURFACE

\$ SPLINE1 = 405 RIGHT-SIDE CONTROL SURFACE ON VERTICAL TAIL

\$

SPLINE1 100	10001	10001	10136	100
SPLINE1 200	20001	20001	20184	200

\$

SPLINE1 300	30001	30001	30160	300
SPLINE1 400	40001	40001	40160	400

\$

SPLINE1 305	31001	31001	31040	305
SPLINE1 405	41001	41001	41040	405

\$

\$ GRIDS UTILIZED FOR RIGHT SIDE INBOARD WING SURFACE SPLINES

SET1	100	101	102	103	104	105	106	107+IW01
+IW01	108	109	110	111	112	113	114	115+IW02
+IW02	116	117	118	1101	1102	1103	1104	1105+IW03
+IW03	1106	1107	1108	1109	1110	1111	1112	1113+IW04
+IW04	1114	1115	1116	1117	1118	2101	2102	2103+IW05
+IW05	2104	2105	2106	2107	2108	2109	2110	2111+IW06
+IW06	2112	2113	2114	2115	2116	2117	2118	

\$ GRIDS UTILIZED FOR RIGHT SIDE OUTBOARD WING SURFACE SPLINES

SET1	200	118	119	120	121	122	123	124+OW01
+OW01	125	126	127	128	129	130	131	132+OW02
+OW02	133	134	135	136	137	138	139	140+OW03
+OW03	141	1118	1119	1120	1121	1122	1123	1124+OW04
+OW04	1125	1126	1127	1128	1129	1130	1131	1132+OW05
+OW05	1133	1134	1135	1136	1137	1138	1139	1140+OW06
+OW06	1141	2118	2119	2120	2121	2122	2123	2124+OW07
+OW07	2125	2126	2127	2128	2129	2130	2131	2132+OW08
+OW08	2133	2134	2135	2136	2137	2138	2139	2140+OW09
+OW09	2141							

\$ GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON H-TAIL

SET1	300	301	302	303	304	305	306	307+HT01
+HT01	308	309	310	311	1301	1302	1303	1304+HT02
+HT02	1305	1306	1307	1308	1309	1310	1311	2501+HT03
+HT03	2502	2503	2504	2505	2506	2507	2508	2509+HT04
+HT04	2510	2511						

\$ GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON H-TAIL CONTROL SURFACE

SET1	305	2501	2502	2503	2504	2505	2506	2507+HC01
+HC01	2508	2509	2510	2511	2301	2302	2303	2304+HC02
+HC02	2305	2306	2307	2308	2309	2310	2311	

\$ GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON V-TAIL

SET1	400	401	402	403	404	405	406	407+VT01
+VT01	408	409	410	411	1401	1402	1403	1404+VT02

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+VT02      1405      1406      1407      1408      1409      1410      1411      2601+VT03
+VT03      2602      2603      2604      2605      2606      2607      2608      2609+VT04
+VT04      2610      2611
$  GRIDS UTILIZED FOR RIGHT SIDE SURFACE SPLINE ON V-TAIL CONTROL SURFACE
SET1        405      2601      2602      2603      2604      2605      2606      2607+VC01
+VC01       2608      2609      2610      2611      2401      2402      2403      2404+VC02
+VC02       2405      2406      2407      2408      2409      2410      2411
$
$ *****  END OF AERODYNAMIC FLUTTER INPUTS  *****
$
EIGR          1      SINV      0.0      60.0              40
$
$  CREATE A NEW GRID POINT AT THE C.G. FOR THE CURRENT FUEL MASS CONDITION
$  USE A CBEAM TO CONNECT THIS NEW GRID TO GRID 101
GRID          95          0160.9484      0.077.08521      0
CBEAM         95          95          101          95          1.0          0.0          0.0
PBEAM         95          1      100.0      1000.0      1000.0          0.0      1000.0
$
$  GRID 100 REPRESENTS PROPULSION SYSTEM
RBE2          504          101      123456          100
$  CONNECTIONS TO WING-TIP BOOM, HORIZONTAL AND VERTICAL TAILS
$
RBE2          501          141      123456          216
RBE2          502          238      123456          301
RBE2          503          240      123456          401
$
GRID          100          0      125.8          0.0      86.1          0
$
$  GRIDS FOR RIGHT WING BEAM
$
GRID          101          0      156.51          0.00      48.98          0
GRID          102          0      156.48          13.15      49.67          0
GRID          103          0      156.45          26.29      50.37          0
GRID          104          0      156.41          39.44      51.06          0
GRID          105          0      156.38          52.59      51.75          0
GRID          106          0      156.34          65.74      52.45          0
GRID          107          0      156.31          78.88      53.14          0
GRID          108          0      156.28          92.03      53.83          0
GRID          109          0      156.24          105.18      54.53          0
GRID          110          0      156.21          118.32      55.22          0
GRID          111          0      156.18          131.47      55.91          0
GRID          112          0      156.14          144.62      56.61          0
GRID          113          0      156.11          157.76      57.30          0
GRID          114          0      156.08          170.91      57.99          0
GRID          115          0      156.04          184.06      58.69          0
GRID          116          0      156.01          197.21      59.38          0
GRID          117          0      155.98          210.35      60.07          0
GRID          118          0      155.94          223.50      60.77          0
GRID          119          0      155.88          236.63      61.46          0
GRID          120          0      155.82          249.76      62.16          0
GRID          121          0      155.76          262.89      62.86          0
GRID          122          0      155.70          276.02      63.55          0
GRID          123          0      155.64          289.15      64.25          0
GRID          124          0      155.58          302.28      64.95          0
GRID          125          0      155.52          315.41      65.64          0
GRID          126          0      155.46          328.54      66.34          0
GRID          127          0      155.39          341.67      67.04          0

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GRID	128	0	155.33	354.80	67.73	0
GRID	129	0	155.27	367.93	68.43	0
GRID	130	0	155.21	381.07	69.13	0
GRID	131	0	155.15	394.20	69.82	0
GRID	132	0	155.09	407.33	70.52	0
GRID	133	0	155.03	420.46	71.22	0
GRID	134	0	154.97	433.59	71.91	0
GRID	135	0	154.91	446.72	72.61	0
GRID	136	0	154.85	459.85	73.31	0
GRID	137	0	154.79	472.98	74.00	0
GRID	138	0	154.72	486.11	74.70	0
GRID	139	0	154.66	499.24	75.40	0
GRID	140	0	154.60	512.37	76.09	0
GRID	141	0	154.54	525.50	76.79	0

\$

\$ RIGHT SIDE WING SURFACE LEADING-EDGE GRID POINTS

\$

GRID	1101	0	132.83	0.00	48.98	0
GRID	1102	0	132.92	13.15	49.67	0
GRID	1103	0	133.01	26.29	50.37	0
GRID	1104	0	133.10	39.44	51.06	0
GRID	1105	0	133.18	52.59	51.75	0
GRID	1106	0	133.27	65.74	52.45	0
GRID	1107	0	133.36	78.88	53.14	0
GRID	1108	0	133.45	92.03	53.83	0
GRID	1109	0	133.54	105.18	54.53	0
GRID	1110	0	133.63	118.32	55.22	0
GRID	1111	0	133.71	131.47	55.91	0
GRID	1112	0	133.80	144.62	56.61	0
GRID	1113	0	133.89	157.76	57.30	0
GRID	1114	0	133.98	170.91	57.99	0
GRID	1115	0	134.07	184.06	58.69	0
GRID	1116	0	134.16	197.21	59.38	0
GRID	1117	0	134.24	210.35	60.07	0
GRID	1118	0	134.33	223.50	60.77	0
GRID	1119	0	134.49	236.63	61.46	0
GRID	1120	0	134.65	249.76	62.16	0
GRID	1121	0	134.81	262.89	62.86	0
GRID	1122	0	134.97	276.02	63.55	0
GRID	1123	0	135.14	289.15	64.25	0
GRID	1124	0	135.30	302.28	64.95	0
GRID	1125	0	135.46	315.41	65.64	0
GRID	1126	0	135.62	328.54	66.34	0
GRID	1127	0	135.78	341.67	67.04	0
GRID	1128	0	135.94	354.80	67.73	0
GRID	1129	0	136.10	367.93	68.43	0
GRID	1130	0	136.26	381.07	69.13	0
GRID	1131	0	136.42	394.20	69.82	0
GRID	1132	0	136.58	407.33	70.52	0
GRID	1133	0	136.74	420.46	71.22	0
GRID	1134	0	136.90	433.59	71.91	0
GRID	1135	0	137.06	446.72	72.61	0
GRID	1136	0	137.22	459.85	73.31	0
GRID	1137	0	137.38	472.98	74.00	0
GRID	1138	0	137.55	486.11	74.70	0
GRID	1139	0	137.71	499.24	75.40	0
GRID	1140	0	137.87	512.37	76.09	0

GRID	1141	0	138.03	525.50	76.79	0
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\$

\$ RIGHT SIDE WING SURFACE TRAILING-EDGE GRID POINTS

\$

GRID	2101	0	192.03	0.00	48.98	0
GRID	2102	0	191.82	13.15	49.67	0
GRID	2103	0	191.60	26.29	50.37	0
GRID	2104	0	191.39	39.44	51.06	0
GRID	2105	0	191.17	52.59	51.75	0
GRID	2106	0	190.95	65.74	52.45	0
GRID	2107	0	190.74	78.88	53.14	0
GRID	2108	0	190.52	92.03	53.83	0
GRID	2109	0	190.30	105.18	54.53	0
GRID	2110	0	190.09	118.32	55.22	0
GRID	2111	0	189.87	131.47	55.91	0
GRID	2112	0	189.66	144.62	56.61	0
GRID	2113	0	189.44	157.76	57.30	0
GRID	2114	0	189.22	170.91	57.99	0
GRID	2115	0	189.01	184.06	58.69	0
GRID	2116	0	188.79	197.21	59.38	0
GRID	2117	0	188.58	210.35	60.07	0
GRID	2118	0	188.36	223.50	60.77	0
GRID	2119	0	187.97	236.63	61.46	0
GRID	2120	0	187.57	249.76	62.16	0
GRID	2121	0	187.18	262.89	62.86	0
GRID	2122	0	186.79	276.02	63.55	0
GRID	2123	0	186.39	289.15	64.25	0
GRID	2124	0	186.00	302.28	64.95	0
GRID	2125	0	185.61	315.41	65.64	0
GRID	2126	0	185.21	328.54	66.34	0
GRID	2127	0	184.82	341.67	67.04	0
GRID	2128	0	184.43	354.80	67.73	0
GRID	2129	0	184.03	367.93	68.43	0
GRID	2130	0	183.64	381.07	69.13	0
GRID	2131	0	183.25	394.20	69.82	0
GRID	2132	0	182.85	407.33	70.52	0
GRID	2133	0	182.46	420.46	71.22	0
GRID	2134	0	182.07	433.59	71.91	0
GRID	2135	0	181.67	446.72	72.61	0
GRID	2136	0	181.28	459.85	73.31	0
GRID	2137	0	180.89	472.98	74.00	0
GRID	2138	0	180.49	486.11	74.70	0
GRID	2139	0	180.10	499.24	75.40	0
GRID	2140	0	179.71	512.37	76.09	0
GRID	2141	0	179.31	525.50	76.79	0

\$

\$ RIGHT WING * LEADING AND TRAILING EDGE GRIDS ARE DEPENDENT ON MAIN BEAM

\$

RBE2	1201	101	123456	1101	2101
RBE2	1202	102	123456	1102	2102
RBE2	1203	103	123456	1103	2103
RBE2	1204	104	123456	1104	2104
RBE2	1205	105	123456	1105	2105
RBE2	1206	106	123456	1106	2106
RBE2	1207	107	123456	1107	2107
RBE2	1208	108	123456	1108	2108
RBE2	1209	109	123456	1109	2109

RBE2	1210	110	123456	1110	2110
RBE2	1211	111	123456	1111	2111
RBE2	1212	112	123456	1112	2112
RBE2	1213	113	123456	1113	2113
RBE2	1214	114	123456	1114	2114
RBE2	1215	115	123456	1115	2115
RBE2	1216	116	123456	1116	2116
RBE2	1217	117	123456	1117	2117
RBE2	1218	118	123456	1118	2118
RBE2	1219	119	123456	1119	2119
RBE2	1220	120	123456	1120	2120
RBE2	1221	121	123456	1121	2121
RBE2	1222	122	123456	1122	2122
RBE2	1223	123	123456	1123	2123
RBE2	1224	124	123456	1124	2124
RBE2	1225	125	123456	1125	2125
RBE2	1226	126	123456	1126	2126
RBE2	1227	127	123456	1127	2127
RBE2	1228	128	123456	1128	2128
RBE2	1229	129	123456	1129	2129
RBE2	1230	130	123456	1130	2130
RBE2	1231	131	123456	1131	2131
RBE2	1232	132	123456	1132	2132
RBE2	1233	133	123456	1133	2133
RBE2	1234	134	123456	1134	2134
RBE2	1235	135	123456	1135	2135
RBE2	1236	136	123456	1136	2136
RBE2	1237	137	123456	1137	2137
RBE2	1238	138	123456	1138	2138
RBE2	1239	139	123456	1139	2139
RBE2	1240	140	123456	1140	2140
RBE2	1241	141	123456	1141	2141

\$

\$ GRIDS FOR RIGHT SIDE WING-TIP BOOM

\$

GRID	201	0	25.	525.5	77.5	0
GRID	202	0	33.6111	525.5	77.5	0
GRID	203	0	42.2222	525.5	77.5	0
GRID	204	0	50.8333	525.5	77.5	0
GRID	205	0	59.4444	525.5	77.5	0
GRID	206	0	68.0556	525.5	77.5	0
GRID	207	0	76.6667	525.5	77.5	0
GRID	208	0	85.2778	525.5	77.5	0
GRID	209	0	93.8889	525.5	77.5	0
GRID	210	0	102.5	525.5	77.5	0
GRID	211	0	111.111	525.5	77.5	0
GRID	212	0	119.722	525.5	77.5	0
GRID	213	0	128.333	525.5	77.5	0
GRID	214	0	136.944	525.5	77.5	0
GRID	215	0	145.556	525.5	77.5	0
GRID	216	0	154.167	525.5	77.5	0
GRID	217	0	162.778	525.5	77.5	0
GRID	218	0	171.389	525.5	77.5	0
GRID	219	0	180.	525.5	77.5	0
GRID	220	0	190.	525.5	77.5	0
GRID	221	0	200.	525.5	77.5	0
GRID	222	0	210.	525.5	77.5	0

GRID	223	0	220.	525.5	77.5	0
GRID	224	0	230.	525.5	77.5	0
GRID	225	0	240.	525.5	77.5	0
GRID	226	0	250.	525.5	77.5	0
GRID	227	0	260.	525.5	77.5	0
GRID	228	0	270.	525.5	77.5	0
GRID	229	0	280.	525.5	77.5	0
GRID	230	0	290.	525.5	77.5	0
GRID	231	0	300.	525.5	77.5	0
GRID	232	0	310.	525.5	77.5	0
GRID	233	0	320.	525.5	77.5	0
GRID	234	0	330.	525.5	77.5	0
GRID	235	0	340.	525.5	77.5	0
GRID	236	0	350.	525.5	77.5	0
GRID	237	0	360.	525.5	77.5	0
GRID	238	0	370.	525.5	77.5	0
GRID	239	0	380.	525.5	77.5	0
GRID	240	0	390.	525.5	77.5	0
GRID	241	0	400.	525.5	77.5	0
GRID	242	0	410.	525.5	77.5	0
GRID	243	0	420.	525.5	77.5	0

\$

\$ *****

\$ RIGHT SIDE HORIZONTAL TAIL DEFINITION

\$ *****

\$ GRIDS FOR RIGHT SIDE HORIZONTAL TAIL BEAM

\$

GRID	301	0	379.75	525.50	77.36	0
GRID	302	0	379.61	535.00	79.01	0
GRID	303	0	379.47	544.50	80.67	0
GRID	304	0	379.34	554.00	82.33	0
GRID	305	0	379.20	563.50	83.98	0
GRID	306	0	379.06	573.00	85.64	0
GRID	307	0	378.92	582.50	87.30	0
GRID	308	0	378.79	592.00	88.95	0
GRID	309	0	378.65	601.50	90.61	0
GRID	310	0	378.51	611.00	92.27	0
GRID	311	0	378.37	620.50	93.92	0

\$ DUPLICATE GRIDS FOR HORIZONTAL TAIL MAIN BEAM

\$ THE OUTPUT OF THESE GRIDS WILL BE IN COORD. SYST. 5

GRID	331	0	379.75	525.50	77.36	5
GRID	332	0	379.61	535.00	79.01	5
GRID	333	0	379.47	544.50	80.67	5
GRID	334	0	379.34	554.00	82.33	5
GRID	335	0	379.20	563.50	83.98	5
GRID	336	0	379.06	573.00	85.64	5
GRID	337	0	378.92	582.50	87.30	5
GRID	338	0	378.79	592.00	88.95	5
GRID	339	0	378.65	601.50	90.61	5
GRID	340	0	378.51	611.00	92.27	5
GRID	341	0	378.37	620.50	93.92	5

\$ DUPLICATE GRIDS ON H-TAIL ARE DEPENDENT ON ELASTIC AXIS BEAM

RBE2	521	301	123456	331
RBE2	522	302	123456	332
RBE2	523	303	123456	333
RBE2	524	304	123456	334
RBE2	525	305	123456	335

RBE2	526	306	123456	336
RBE2	527	307	123456	337
RBE2	528	308	123456	338
RBE2	529	309	123456	339
RBE2	530	310	123456	340
RBE2	531	311	123456	341

\$

\$ RIGHT SIDE HORIZONTAL TAIL LEADING EDGE

\$

GRID	1301	0	355.08	525.50	77.36	0
GRID	1302	0	356.17	535.00	79.01	0
GRID	1303	0	357.27	544.50	80.67	0
GRID	1304	0	358.36	554.00	82.33	0
GRID	1305	0	359.46	563.50	83.98	0
GRID	1306	0	360.56	573.00	85.64	0
GRID	1307	0	361.65	582.50	87.30	0
GRID	1308	0	362.75	592.00	88.95	0
GRID	1309	0	363.85	601.50	90.61	0
GRID	1310	0	364.94	611.00	92.27	0
GRID	1311	0	366.04	620.50	93.92	0

\$

\$ DISPLACEMENT OF H-TAIL L.E. IS DEPENDENT ON ELASTIC AXIS

RBE2	1251	301	123456	1301
RBE2	1252	302	123456	1302
RBE2	1253	303	123456	1303
RBE2	1254	304	123456	1304
RBE2	1255	305	123456	1305
RBE2	1256	306	123456	1306
RBE2	1257	307	123456	1307
RBE2	1258	308	123456	1308
RBE2	1259	309	123456	1309
RBE2	1260	310	123456	1310
RBE2	1261	311	123456	1311

\$

\$ DUPLICATE GRIDS FOR HORIZONTAL TAIL LEADING EDGE

\$ THE OUTPUT OF THESE GRIDS WILL BE IN COORD. SYST. 5

GRID	1331	0	355.08	525.50	77.36	5
GRID	1332	0	356.17	535.00	79.01	5
GRID	1333	0	357.27	544.50	80.67	5
GRID	1334	0	358.36	554.00	82.33	5
GRID	1335	0	359.46	563.50	83.98	5
GRID	1336	0	360.56	573.00	85.64	5
GRID	1337	0	361.65	582.50	87.30	5
GRID	1338	0	362.75	592.00	88.95	5
GRID	1339	0	363.85	601.50	90.61	5
GRID	1340	0	364.94	611.00	92.27	5
GRID	1341	0	366.04	620.50	93.92	5

\$ DUPLICATE GRIDS ON H-TAIL LEADING EDGE ARE DEPENDENT ON ELASTIC AXIS

RBE2	541	301	123456	1331
RBE2	542	302	123456	1332
RBE2	543	303	123456	1333
RBE2	544	304	123456	1334
RBE2	545	305	123456	1335
RBE2	546	306	123456	1336
RBE2	547	307	123456	1337
RBE2	548	308	123456	1338
RBE2	549	309	123456	1339

RBE2	550	310	123456	1340
RBE2	551	311	123456	1341

\$

\$ RIGHT SIDE HORIZONTAL TAIL TRAILING EDGE

\$

GRID	2301	0	416.83	525.50	77.36	0
GRID	2302	0	414.84	535.00	79.01	0
GRID	2303	0	412.85	544.50	80.67	0
GRID	2304	0	410.86	554.00	82.33	0
GRID	2305	0	408.87	563.50	83.98	0
GRID	2306	0	406.88	573.00	85.64	0
GRID	2307	0	404.88	582.50	87.30	0
GRID	2308	0	402.89	592.00	88.95	0
GRID	2309	0	400.90	601.50	90.61	0
GRID	2310	0	398.91	611.00	92.27	0
GRID	2311	0	396.92	620.50	93.92	0

\$ DUPLICATE GRIDS FOR HORIZONTAL TAIL TRAILING EDGE

\$ THE OUTPUT FOR THESE GRIDS WILL BE IN COORD. SYST. 5

GRID	2331	0	416.83	525.50	77.36	5
GRID	2332	0	414.84	535.00	79.01	5
GRID	2333	0	412.85	544.50	80.67	5
GRID	2334	0	410.86	554.00	82.33	5
GRID	2335	0	408.87	563.50	83.98	5
GRID	2336	0	406.88	573.00	85.64	5
GRID	2337	0	404.88	582.50	87.30	5
GRID	2338	0	402.89	592.00	88.95	5
GRID	2339	0	400.90	601.50	90.61	5
GRID	2340	0	398.91	611.00	92.27	5
GRID	2341	0	396.92	620.50	93.92	5

\$ DUPLICATE H-TAIL T.E. GRIDS ARE DEPENDENT ON ORIGINAL T.E. GRIDS

RBE2	561	2301	123456	2331
RBE2	562	2302	123456	2332
RBE2	563	2303	123456	2333
RBE2	564	2304	123456	2334
RBE2	565	2305	123456	2335
RBE2	566	2306	123456	2336
RBE2	567	2307	123456	2337
RBE2	568	2308	123456	2338
RBE2	569	2309	123456	2339
RBE2	570	2310	123456	2340
RBE2	571	2311	123456	2341

\$

\$ GRIDS AT 80% CHORD HINGE-LINE OF RIGHT SIDE HORIZONTAL TAIL

GRID	2501	0	404.480	525.500	77.360	0
GRID	2502	0	403.106	535.000	79.010	0
GRID	2503	0	401.734	544.500	80.670	0
GRID	2504	0	400.360	554.000	82.330	0
GRID	2505	0	398.988	563.500	83.980	0
GRID	2506	0	397.616	573.000	85.640	0
GRID	2507	0	396.234	582.500	87.300	0
GRID	2508	0	394.862	592.000	88.950	0
GRID	2509	0	393.490	601.500	90.610	0
GRID	2510	0	392.116	611.000	92.270	0
GRID	2511	0	390.744	620.500	93.920	0

\$

\$ *****

\$ END OF RIGHT SIDE HORIZONTAL TAIL DEFINITION

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$ *****
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$ *****
$ RIGHT SIDE VERTICAL TAIL DEFINITION
$ *****
$
$ GRIDS FOR RIGHT SIDE VERTICAL TAIL BEAM
GRID      401      0  410.39  525.50  77.50      0
GRID      402      0  411.39  522.60  85.47      0
GRID      403      0  412.38  519.70  93.44      0
GRID      404      0  413.38  516.80  101.41     0
GRID      405      0  414.37  513.90  109.38     0
GRID      406      0  415.37  511.00  117.34     0
GRID      407      0  416.36  508.10  125.31     0
GRID      408      0  417.36  505.20  133.28     0
GRID      409      0  418.35  502.30  141.25     0
GRID      410      0  419.35  499.40  149.22     0
GRID      411      0  420.34  496.50  157.19     0
$ THIS GROUP OF GRIDS GENERATES OUTPUT IN COORD. SYSTEM 6
$ THE Z-AXIS FOR COORD. SYS. 5 IS NORMAL TO PLANE OF V-TAIL
GRID      431      0  410.39  525.50  77.50      6
GRID      432      0  411.39  522.60  85.47      6
GRID      433      0  412.38  519.70  93.44      6
GRID      434      0  413.38  516.80  101.41     6
GRID      435      0  414.37  513.90  109.38     6
GRID      436      0  415.37  511.00  117.34     6
GRID      437      0  416.36  508.10  125.31     6
GRID      438      0  417.36  505.20  133.28     6
GRID      439      0  418.35  502.30  141.25     6
GRID      440      0  419.35  499.40  149.22     6
GRID      441      0  420.34  496.50  157.19     6
$ DUPLICATE GRIDS OF MAIN V-TAIL ARE DEPENDENT ON ELASTIC AXIS GRIDS
RBE2      581      401  123456      431
RBE2      582      402  123456      432
RBE2      583      403  123456      433
RBE2      584      404  123456      434
RBE2      585      405  123456      435
RBE2      586      406  123456      436
RBE2      587      407  123456      437
RBE2      588      408  123456      438
RBE2      589      409  123456      439
RBE2      590      410  123456      440
RBE2      591      411  123456      441
$
$ RIGHT SIDE VERTICAL TAIL LEADING EDGE
$
GRID      1401      0  390.67  525.50  77.50      0
GRID      1402      0  392.36  522.60  85.47      0
GRID      1403      0  394.05  519.70  93.44      0
GRID      1404      0  395.73  516.80  101.41     0
GRID      1405      0  397.42  513.90  109.38     0
GRID      1406      0  399.11  511.00  117.34     0
GRID      1407      0  400.79  508.10  125.31     0
GRID      1408      0  402.48  505.20  133.28     0
GRID      1409      0  404.17  502.30  141.25     0
GRID      1410      0  405.85  499.40  149.22     0
GRID      1411      0  407.54  496.50  157.19     0

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\$

\$ LEADING EDGE V-TAIL GRIDS ARE DEPENDENT ON ELASTIC AXIS

RBE2	1271	401	123456	1401
RBE2	1272	402	123456	1402
RBE2	1273	403	123456	1403
RBE2	1274	404	123456	1404
RBE2	1275	405	123456	1405
RBE2	1276	406	123456	1406
RBE2	1277	407	123456	1407
RBE2	1278	408	123456	1408
RBE2	1279	409	123456	1409
RBE2	1280	410	123456	1410
RBE2	1281	411	123456	1411

\$

\$ DUPLICATE GRIDS FOR VERTICAL TAIL LEADING EDGE

\$ THE OUTPUT OF THESE GRIDS WILL BE IN COORD. SYST. 6

GRID	1431	0	390.67	525.50	77.50	6
GRID	1432	0	392.36	522.60	85.47	6
GRID	1433	0	394.05	519.70	93.44	6
GRID	1434	0	395.73	516.80	101.41	6
GRID	1435	0	397.42	513.90	109.38	6
GRID	1436	0	399.11	511.00	117.34	6
GRID	1437	0	400.79	508.10	125.31	6
GRID	1438	0	402.48	505.20	133.28	6
GRID	1439	0	404.17	502.30	141.25	6
GRID	1440	0	405.85	499.40	149.22	6
GRID	1441	0	407.54	496.50	157.19	6

\$ V-TAIL LEADING EDGE DUPLICATE GRIDS ARE DEPENDENT ON ELASTIC AXIS GRIDS

RBE2	601	401	123456	1431
RBE2	602	402	123456	1432
RBE2	603	403	123456	1433
RBE2	604	404	123456	1434
RBE2	605	405	123456	1435
RBE2	606	406	123456	1436
RBE2	607	407	123456	1437
RBE2	608	408	123456	1438
RBE2	609	409	123456	1439
RBE2	610	410	123456	1440
RBE2	611	411	123456	1441

\$

\$ RIGHT SIDE VERTICAL TAIL TRAILING EDGE

\$

GRID	2401	0	439.97	525.50	77.50	0
GRID	2402	0	439.93	522.60	85.47	0
GRID	2403	0	439.89	519.70	93.44	0
GRID	2404	0	439.84	516.80	101.41	0
GRID	2405	0	439.80	513.90	109.38	0
GRID	2406	0	439.76	511.00	117.34	0
GRID	2407	0	439.71	508.10	125.31	0
GRID	2408	0	439.67	505.20	133.28	0
GRID	2409	0	439.63	502.30	141.25	0
GRID	2410	0	439.58	499.40	149.22	0
GRID	2411	0	439.54	496.50	157.19	0

\$ DUPLICATE GRIDS FOR VERTICAL TAIL TRAILING EDGE

\$ THE OUTPUT FOR THESE GRIDS WILL BE IN COORD. SYST. 6

GRID	2431	0	439.97	525.50	77.50	6
GRID	2432	0	439.93	522.60	85.47	6

GRID	2433	0	439.89	519.70	93.44	6
GRID	2434	0	439.84	516.80	101.41	6
GRID	2435	0	439.80	513.90	109.38	6
GRID	2436	0	439.76	511.00	117.34	6
GRID	2437	0	439.71	508.10	125.31	6
GRID	2438	0	439.67	505.20	133.28	6
GRID	2439	0	439.63	502.30	141.25	6
GRID	2440	0	439.58	499.40	149.22	6
GRID	2441	0	439.54	496.50	157.19	6

\$ DUPLICATE V-TAIL T.E. GRIDS ARE DEPENDENT ON ORIGINAL GRIDS

RBE2	621	2401	123456	2431
RBE2	622	2402	123456	2432
RBE2	623	2403	123456	2433
RBE2	624	2404	123456	2434
RBE2	625	2405	123456	2435
RBE2	626	2406	123456	2436
RBE2	627	2407	123456	2437
RBE2	628	2408	123456	2438
RBE2	629	2409	123456	2439
RBE2	630	2410	123456	2440
RBE2	631	2411	123456	2441

\$

\$ GRIDS AT 80% CHORD HINGE-LINE OF RIGHT SIDE VERTICAL TAIL

GRID	2601	0	430.110	525.500	77.500	0
GRID	2602	0	430.416	522.600	85.470	0
GRID	2603	0	430.722	519.700	93.440	0
GRID	2604	0	431.018	516.800	101.410	0
GRID	2605	0	431.324	513.900	109.380	0
GRID	2606	0	431.630	511.000	117.340	0
GRID	2607	0	431.926	508.100	125.310	0
GRID	2608	0	432.232	505.200	133.280	0
GRID	2609	0	432.538	502.300	141.250	0
GRID	2610	0	432.834	499.400	149.220	0
GRID	2611	0	433.140	496.500	157.190	0

\$

\$ *****

\$ END OF RIGHT SIDE VERTICAL TAIL DEFINITION

\$ *****

\$

\$

\$ MAIN BEAMS FOR RIGHT WING

CBEAM	101	101	101	102	-1.	0.	0.
CBEAM	102	102	102	103	-1.	0.	0.
CBEAM	103	103	103	104	-1.	0.	0.
CBEAM	104	104	104	105	-1.	0.	0.
CBEAM	105	105	105	106	-1.	0.	0.
CBEAM	106	106	106	107	-1.	0.	0.
CBEAM	107	107	107	108	-1.	0.	0.
CBEAM	108	108	108	109	-1.	0.	0.
CBEAM	109	109	109	110	-1.	0.	0.
CBEAM	110	110	110	111	-1.	0.	0.
CBEAM	111	111	111	112	-1.	0.	0.
CBEAM	112	112	112	113	-1.	0.	0.
CBEAM	113	113	113	114	-1.	0.	0.
CBEAM	114	114	114	115	-1.	0.	0.
CBEAM	115	115	115	116	-1.	0.	0.
CBEAM	116	116	116	117	-1.	0.	0.
CBEAM	117	117	117	118	-1.	0.	0.

CBEAM	118	118	118	119	-1.	0.	0.
CBEAM	119	119	119	120	-1.	0.	0.
CBEAM	120	120	120	121	-1.	0.	0.
CBEAM	121	121	121	122	-1.	0.	0.
CBEAM	122	122	122	123	-1.	0.	0.
CBEAM	123	123	123	124	-1.	0.	0.
CBEAM	124	124	124	125	-1.	0.	0.
CBEAM	125	125	125	126	-1.	0.	0.
CBEAM	126	126	126	127	-1.	0.	0.
CBEAM	127	127	127	128	-1.	0.	0.
CBEAM	128	128	128	129	-1.	0.	0.
CBEAM	129	129	129	130	-1.	0.	0.
CBEAM	130	130	130	131	-1.	0.	0.
CBEAM	131	131	131	132	-1.	0.	0.
CBEAM	132	132	132	133	-1.	0.	0.
CBEAM	133	133	133	134	-1.	0.	0.
CBEAM	134	134	134	135	-1.	0.	0.
CBEAM	135	135	135	136	-1.	0.	0.
CBEAM	136	136	136	137	-1.	0.	0.
CBEAM	137	137	137	138	-1.	0.	0.
CBEAM	138	138	138	139	-1.	0.	0.
CBEAM	139	139	139	140	-1.	0.	0.
CBEAM	140	140	140	141	-1.	0.	0.
\$ BEAMS FOR RIGHT WING TIP BOOM							
CBEAM	201	201	201	202	0.	1.	0.
CBEAM	202	202	202	203	0.	1.	0.
CBEAM	203	203	203	204	0.	1.	0.
CBEAM	204	204	204	205	0.	1.	0.
CBEAM	205	205	205	206	0.	1.	0.
CBEAM	206	206	206	207	0.	1.	0.
CBEAM	207	207	207	208	0.	1.	0.
CBEAM	208	208	208	209	0.	1.	0.
CBEAM	209	209	209	210	0.	1.	0.
CBEAM	210	210	210	211	0.	1.	0.
CBEAM	211	211	211	212	0.	1.	0.
CBEAM	212	212	212	213	0.	1.	0.
CBEAM	213	213	213	214	0.	1.	0.
CBEAM	214	214	214	215	0.	1.	0.
CBEAM	215	215	215	216	0.	1.	0.
CBEAM	216	216	216	217	0.	1.	0.
CBEAM	217	217	217	218	0.	1.	0.
CBEAM	218	218	218	219	0.	1.	0.
CBEAM	219	219	219	220	0.	1.	0.
CBEAM	220	220	220	221	0.	1.	0.
CBEAM	221	221	221	222	0.	1.	0.
CBEAM	222	222	222	223	0.	1.	0.
CBEAM	223	223	223	224	0.	1.	0.
CBEAM	224	224	224	225	0.	1.	0.
CBEAM	225	225	225	226	0.	1.	0.
CBEAM	226	226	226	227	0.	1.	0.
CBEAM	227	227	227	228	0.	1.	0.
CBEAM	228	228	228	229	0.	1.	0.
CBEAM	229	229	229	230	0.	1.	0.
CBEAM	230	230	230	231	0.	1.	0.
CBEAM	231	231	231	232	0.	1.	0.
CBEAM	232	232	232	233	0.	1.	0.
CBEAM	233	233	233	234	0.	1.	0.

CBEAM	234	234	234	235	0.	1.	0.
CBEAM	235	235	235	236	0.	1.	0.
CBEAM	236	236	236	237	0.	1.	0.
CBEAM	237	237	237	238	0.	1.	0.
CBEAM	238	238	238	239	0.	1.	0.
CBEAM	239	239	239	240	0.	1.	0.
CBEAM	240	240	240	241	0.	1.	0.
CBEAM	241	241	241	242	0.	1.	0.
CBEAM	242	242	242	243	0.	1.	0.

\$ RIGHT SIDE HORIZONTAL TAIL BEAMS

CBEAM	301	301	301	302	-1.	0.	0.
CBEAM	302	302	302	303	-1.	0.	0.
CBEAM	303	303	303	304	-1.	0.	0.
CBEAM	304	304	304	305	-1.	0.	0.
CBEAM	305	305	305	306	-1.	0.	0.
CBEAM	306	306	306	307	-1.	0.	0.
CBEAM	307	307	307	308	-1.	0.	0.
CBEAM	308	308	308	309	-1.	0.	0.
CBEAM	309	309	309	310	-1.	0.	0.
CBEAM	310	310	310	311	-1.	0.	0.

\$ RIGHT SIDE VERTICAL TAIL BEAMS

CBEAM	401	401	401	402	1.	0.	0.
CBEAM	402	402	402	403	1.	0.	0.
CBEAM	403	403	403	404	1.	0.	0.
CBEAM	404	404	404	405	1.	0.	0.
CBEAM	405	405	405	406	1.	0.	0.
CBEAM	406	406	406	407	1.	0.	0.
CBEAM	407	407	407	408	1.	0.	0.
CBEAM	408	408	408	409	1.	0.	0.
CBEAM	409	409	409	410	1.	0.	0.
CBEAM	410	410	410	411	1.	0.	0.

\$

\$ BEAM PROPERTIES FOR RIGHT WING ELASTIC AXIS

PBEAM	101	1	1000.	1021.	247.3	0.	174.3	0.
PBEAM	102	1	1000.	1005.	227.7	0.	171.5	0.
PBEAM	103	1	1000.	989.3	208.8	0.	168.7	0.
PBEAM	104	1	1000.	974.	190.5	0.	166.	0.
PBEAM	105	1	1000.	958.7	173.	0.	163.3	0.
PBEAM	106	1	1000.	943.7	156.2	0.	160.6	0.
PBEAM	107	1	1000.	928.8	140.2	0.	157.9	0.
PBEAM	108	1	1000.	914.	124.8	0.	155.3	0.
PBEAM	109	1	1000.	899.4	110.3	0.	152.7	0.
PBEAM	110	1	1000.	885.	96.95	0.	150.1	0.
PBEAM	111	1	1000.	870.7	92.06	0.	147.6	0.
PBEAM	112	1	1000.	856.6	86.48	0.	145.1	0.
PBEAM	113	1	1000.	842.6	79.99	0.	142.6	0.
PBEAM	114	1	1000.	828.8	75.44	0.	140.1	0.
PBEAM	115	1	1000.	815.2	71.21	0.	137.7	0.
PBEAM	116	1	1000.	801.6	68.65	0.	135.3	0.
PBEAM	117	1	1000.	788.3	67.96	0.	133.	0.
PBEAM	118	1	1000.	769.7	66.91	0.	129.7	0.
PBEAM	119	1	1000.	746.1	65.52	0.	125.5	0.
PBEAM	120	1	1000.	723.1	64.11	0.	121.4	0.
PBEAM	121	1	1000.	700.5	62.75	0.	117.4	0.
PBEAM	122	1	1000.	678.4	61.39	0.	113.5	0.
PBEAM	123	1	1000.	656.7	60.02	0.	109.7	0.
PBEAM	124	1	1000.	635.5	58.67	0.	106.	0.

PBEAM	125	1	1000.	614.8	57.33	0.	102.3	0.
PBEAM	126	1	1000.	594.6	56.01	0.	98.78	0.
PBEAM	127	1	1000.	574.8	54.7	0.	95.3	0.
PBEAM	128	1	1000.	555.4	53.4	0.	91.91	0.
PBEAM	129	1	1000.	536.5	52.12	0.	88.6	0.
PBEAM	130	1	1000.	518.	50.86	0.	85.37	0.
PBEAM	131	1	1000.	499.9	49.61	0.	82.22	0.
PBEAM	132	1	1000.	482.3	48.37	0.	79.15	0.
PBEAM	133	1	1000.	465.1	47.15	0.	76.15	0.
PBEAM	134	1	1000.	448.3	45.95	0.	73.23	0.
PBEAM	135	1	1000.	431.9	44.76	0.	70.39	0.
PBEAM	136	1	1000.	415.9	43.58	0.	67.62	0.
PBEAM	137	1	1000.	400.3	42.42	0.	64.93	0.
PBEAM	138	1	1000.	385.1	41.27	0.	62.3	0.
PBEAM	139	1	1000.	370.3	40.14	0.	59.75	0.
PBEAM	140	1	1000.	355.9	39.03	0.	57.27	0.
\$ BEAM PROPERTIES FOR RIGHT WING TIP BOOM								
PBEAM	201	2	1000.	83.46	90.29	0.	238.6	0.
PBEAM	202	2	1000.	132.9	146.5	0.	238.6	0.
PBEAM	203	2	1000.	182.3	202.8	0.	238.6	0.
PBEAM	204	2	1000.	231.8	259.1	0.	238.6	0.
PBEAM	205	2	1000.	281.2	315.3	0.	238.6	0.
PBEAM	206	2	1000.	330.7	371.6	0.	238.6	0.
PBEAM	207	2	1000.	380.1	427.8	0.	238.6	0.
PBEAM	208	2	1000.	429.5	484.1	0.	238.6	0.
PBEAM	209	2	1000.	479.	540.4	0.	238.6	0.
PBEAM	210	2	1000.	528.4	596.6	0.	238.6	0.
PBEAM	211	2	1000.	577.8	652.9	0.	238.6	0.
PBEAM	212	2	1000.	627.3	709.1	0.	238.6	0.
PBEAM	213	2	1000.	676.7	765.4	0.	238.6	0.
PBEAM	214	2	1000.	726.2	821.7	0.	238.6	0.
PBEAM	215	2	1000.	704.4	793.9	0.	238.6	0.
PBEAM	216	2	1000.	682.7	766.2	0.	238.6	0.
PBEAM	217	2	1000.	661.	738.4	0.	238.6	0.
PBEAM	218	2	1000.	639.3	710.7	0.	238.6	0.
PBEAM	219	2	1000.	597.	659.8	0.	221.1	0.
PBEAM	220	2	1000.	556.2	610.7	0.	204.5	0.
PBEAM	221	2	1000.	516.7	563.3	0.	188.8	0.
PBEAM	222	2	1000.	478.6	517.7	0.	173.9	0.
PBEAM	223	2	1000.	441.9	473.7	0.	159.8	0.
PBEAM	224	2	1000.	406.6	431.5	0.	146.5	0.
PBEAM	225	2	1000.	372.6	391.1	0.	134.	0.
PBEAM	226	2	1000.	340.	352.3	0.	122.1	0.
PBEAM	227	2	1000.	308.8	315.3	0.	111.	0.
PBEAM	228	2	1000.	278.9	279.9	0.	100.6	0.
PBEAM	229	2	1000.	253.6	249.5	0.	113.6	0.
PBEAM	230	2	1000.	226.1	217.3	0.	102.3	0.
PBEAM	231	2	1000.	200.	186.8	0.	91.71	0.
PBEAM	232	2	1000.	177.6	160.2	0.	98.27	0.
PBEAM	233	2	1000.	153.9	132.9	0.	87.36	0.
PBEAM	234	2	1000.	131.7	107.3	0.	77.29	0.
PBEAM	235	2	1000.	112.4	85.01	0.	79.37	0.
PBEAM	236	2	1000.	94.08	64.02	0.	79.38	0.
PBEAM	237	2	1000.	75.6	43.23	0.	69.04	0.
PBEAM	238	2	1000.	59.53	25.2	0.	67.1	0.
PBEAM	239	2	1000.	44.55	8.614	0.	63.92	0.
PBEAM	240	2	1000.	30.7	8.007	0.	59.78	0.

PBEAM	241	2	1000.	14.37	3.655	0.	27.47	0.
PBEAM	242	2	1000.	3.024	3.024	0.	22.9	0.
\$ BEAM PROPERTIES FOR RIGHT SIDE HORIZONTAL TAIL								
PBEAM	301	3	1000.	1047.	54.91	0.	179.	0.
PBEAM	302	3	1000.	894.1	41.7	0.	151.7	0.
PBEAM	303	3	1000.	756.8	30.83	0.	127.4	0.
PBEAM	304	3	1000.	634.3	22.05	0.	105.8	0.
PBEAM	305	3	1000.	525.8	15.11	0.	86.74	0.
PBEAM	306	3	1000.	430.5	9.772	0.	70.15	0.
PBEAM	307	3	1000.	347.4	5.823	0.	55.82	0.
PBEAM	308	3	1000.	275.8	3.046	0.	43.59	0.
PBEAM	309	3	1000.	214.8	1.241	0.	33.28	0.
PBEAM	310	3	1000.	163.5	0.2188	0.	24.75	0.
\$ BEAM PROPERTIES FOR RIGHT SIDE VERTICAL TAIL								
PBEAM	401	4	1000.	542.6	24.42	0.	73.63	0.
PBEAM	402	4	1000.	486.7	18.52	0.	66.03	0.
PBEAM	403	4	1000.	434.7	13.68	0.	58.98	0.
PBEAM	404	4	1000.	386.6	9.785	0.	52.45	0.
PBEAM	405	4	1000.	342.1	6.712	0.	46.42	0.
PBEAM	406	4	1000.	301.3	4.35	0.	40.87	0.
PBEAM	407	4	1000.	263.8	2.599	0.	35.79	0.
PBEAM	408	4	1000.	229.5	1.365	0.	31.14	0.
PBEAM	409	4	1000.	198.4	0.5584	0.	26.91	0.
PBEAM	410	4	1000.	170.2	0.09922	0.	23.09	0.
\$								
\$ MATERIAL PROPERTIES								
\$ FEMAP Material 1 : Generic - WING AND CHORDWISE SPINES								
MAT1	11000000.1000000.		0.3	0.	0.	0.		
\$								
\$ FEMAP Material 1 : Generic - BOOM								
MAT1	21000000.1000000.		0.3	0.	0.	0.		
\$								
\$ FEMAP Material 1 : Generic - HORIZONTAL								
MAT1	31000000.1000000.		0.3	0.	0.	0.		
\$								
\$ FEMAP Material 1 : Generic - VERTICAL								
MAT1	41000000.1000000.		0.3	0.	0.	0.		
\$								
\$ LUMPED MASSES								
\$ Fuselage Rigid Body Mass (50% for 1/2 symm model)								
\$								
CONM2	601	100	-1	446.1	125.80	0.00	86.1	0
MASS601								
+MASS601	2.64E5	0	8.90E5	0	0	6.95E5		
\$								
\$ *****								
\$ LUMPED MASSES FOR RIGHT-WING								
\$ *****								
\$ RIGHT WING								
CONM2	602	102	-1	7.91	157.54	6.57	49.16	0
MASS602								
CONM2	603	103	-1	7.75	157.67	19.72	49.83	0
MASS603								
CONM2	604	104	-1	7.60	157.80	32.87	50.50	0
MASS604								
CONM2	605	105	-1	7.45	157.92	46.01	51.17	0
MASS605								

\$CONM2	621	121	-1	6.10	158.46	256.33	62.23	0
MASS621								
\$CONM2	622	122	-1	6.05	158.36	269.46	62.93	0
MASS622								
\$CONM2	623	123	-1	6.00	158.26	282.59	63.63	0
MASS623								
\$CONM2	624	124	-1	5.95	158.16	295.72	64.33	0
MASS624								
\$CONM2	625	125	-1	5.91	158.06	308.85	65.03	0
MASS625								
\$CONM2	626	126	-1	5.86	157.96	321.98	65.73	0
MASS626								

\$

\$ No Fuel

\$

\$+MASS620	88.3	0	1485.1	0	0	1573.4
\$+MASS621	87.6	0	1443.1	0	0	1530.7
\$+MASS622	86.9	0	1402.0	0	0	1488.9
\$+MASS623	86.2	0	1361.5	0	0	1447.8
\$+MASS624	85.5	0	1321.9	0	0	1407.5
\$+MASS625	84.9	0	1283.1	0	0	1367.9
\$+MASS626	84.2	0	1245.0	0	0	1329.1

\$

\$ WITH FUEL AT AN ALTITUDE OF 1000 FEET (10/15/98)

\$

CONM2	620	120	-1	25.379	157.65	243.20	61.53	0
MASS620								
CONM2	621	121	-1	24.861	157.57	256.33	62.23	0
MASS621								
CONM2	622	122	-1	24.348	157.49	269.46	62.93	0
MASS622								
CONM2	623	123	-1	23.839	157.41	282.59	63.63	0
MASS623								
CONM2	624	124	-1	23.335	157.33	295.72	64.33	0
MASS624								
CONM2	625	125	-1	22.839	157.25	308.85	65.03	0
MASS625								
CONM2	626	126	-1	22.348	157.17	321.98	65.73	0
MASS626								

\$

\$ WITH FUEL AT AN ALTITUDE OF 1000 FEET (10/15/98)

\$

+MASS620	364.62	0	3931.34	0	0	4090.73
+MASS621	357.16	0	3774.54	0	0	3930.40
+MASS622	349.80	0	3622.52	0	0	3774.90
+MASS623	342.48	0	3475.13	0	0	3624.12
+MASS624	335.29	0	3332.35	0	0	3477.95
+MASS625	328.15	0	3194.03	0	0	3336.28
+MASS626	321.10	0	3060.12	0	0	3199.03

\$

\$ With Fuel

\$

\$ CONM2	620	120	-1	56.86	157.65	243.20	61.53	0
MASS620								
\$ CONM2	621	121	-1	55.70	157.57	256.33	62.23	0
MASS621								

\$ CONM2	622	122	-1	54.55	157.49	269.46	62.93	0
MASS622								
\$ CONM2	623	123	-1	53.41	157.41	282.59	63.63	0
MASS623								
\$ CONM2	624	124	-1	52.28	157.33	295.72	64.33	0
MASS624								
\$ CONM2	625	125	-1	51.17	157.25	308.85	65.03	0
MASS625								
\$ CONM2	626	126	-1	50.07	157.17	321.98	65.73	0
MASS626								
\$								
\$ With Fuel								
\$								
\$ +MASS620	816.9	0	8807.9	0	0	9165.0		
\$ +MASS621	800.2	0	8456.6	0	0	8805.8		
\$ +MASS622	783.7	0	8116.0	0	0	8457.4		
\$ +MASS623	767.3	0	7785.8	0	0	8119.6		
\$ +MASS624	751.2	0	7465.9	0	0	7792.1		
\$ +MASS625	735.2	0	7156.0	0	0	7474.7		
\$ +MASS626	719.4	0	6856.0	0	0	7167.2		
\$								
\$	*****							
\$	END FUEL STATIONS							
\$	*****							
\$								
CONM2	627	127	-1	5.81	157.86	335.11	66.31	0
MASS627								
CONM2	628	128	-1	5.76	157.76	348.24	67.01	0
MASS628								
CONM2	629	129	-1	5.72	157.66	361.37	67.71	0
MASS629								
CONM2	630	130	-1	5.67	157.56	374.50	68.42	0
MASS630								
CONM2	631	131	-1	5.62	157.46	387.63	69.12	0
MASS631								
CONM2	632	132	-1	5.58	157.37	400.76	69.82	0
MASS632								
CONM2	633	133	-1	5.53	157.27	413.89	70.52	0
MASS633								
CONM2	634	134	-1	5.48	157.17	427.02	71.23	0
MASS634								
CONM2	635	135	-1	5.43	157.07	440.15	71.93	0
MASS635								
CONM2	636	136	-1	12.39	155.86	453.28	72.81	0
MASS636								
CONM2	637	137	-1	5.34	156.87	466.41	73.33	0
MASS637								
CONM2	638	138	-1	12.29	155.76	479.54	74.19	0
MASS638								
CONM2	639	139	-1	5.24	156.67	492.67	74.74	0
MASS639								
CONM2	640	140	-1	12.20	155.67	505.80	75.58	0
MASS640								
CONM2	641	141	-1	5.15	156.47	518.93	76.14	0
MASS641								
\$								
\$ +MASS627	83.5	0	1207.6	0	0	1291.1		

+MASS628	82.8	0	1171.0	0	0	1253.8
+MASS629	82.1	0	1135.2	0	0	1217.3
+MASS630	81.5	0	1100.0	0	0	1181.5
+MASS631	80.8	0	1065.6	0	0	1146.4
+MASS632	80.1	0	1031.9	0	0	1112.0
+MASS633	79.4	0	999.0	0	0	1078.4
+MASS634	78.7	0	966.7	0	0	1045.4
+MASS635	78.1	0	935.1	0	0	1013.2
+MASS636	77.4	0	974.4	0	0	974.4
+MASS637	76.7	0	874.0	0	0	950.7
+MASS638	76.0	0	912.3	0	0	912.3
+MASS639	75.3	0	815.6	0	0	890.9
+MASS640	74.7	0	853.1	0	0	853.1
+MASS641	74.0	0	759.8	0	0	833.8

\$

\$ LUMPED MASSES ON RIGHT WING-TIP BOOM

CONM2	702	202	-1	11.25	33.61	525.50	77.50	0
MASS702								
CONM2	703	203	-1	16.33	42.22	525.50	77.50	0
MASS703								
CONM2	704	204	-1	16.41	50.83	525.50	77.50	0
MASS704								
CONM2	705	205	-1	11.48	59.44	525.50	77.50	0
MASS705								
CONM2	706	206	-1	1.56	68.06	525.50	77.50	0
MASS706								
CONM2	707	207	-1	1.64	76.67	525.50	77.50	0
MASS707								
CONM2	708	208	-1	1.72	85.28	525.50	77.50	0
MASS708								
CONM2	709	209	-1	1.79	93.89	525.50	77.50	0
MASS709								
CONM2	710	210	-1	1.87	102.50	525.50	77.50	0
MASS710								
CONM2	711	211	-1	1.95	111.11	525.50	77.50	0
MASS711								
CONM2	712	212	-1	2.02	119.72	525.50	77.50	0
MASS712								
CONM2	713	213	-1	2.10	128.33	525.50	77.50	0
MASS713								
CONM2	714	214	-1	2.18	136.94	525.50	77.50	0
MASS714								
CONM2	715	215	-1	2.25	145.56	525.50	77.50	0
MASS715								
CONM2	716	216	-1	2.22	154.17	525.50	77.50	0
MASS716								
CONM2	717	217	-1	2.18	162.78	525.50	77.50	0
MASS717								
CONM2	718	218	-1	5.65	171.39	525.50	77.50	0
MASS718								
CONM2	719	219	-1	2.11	180.00	525.50	77.50	0
MASS719								
CONM2	720	220	-1	2.41	190.00	525.50	77.50	0
MASS720								
CONM2	721	221	-1	2.35	200.00	525.50	77.50	0
MASS721								

CONM2	722	222	-1	2.30	210.00	525.50	77.50	0
MASS722								
CONM2	723	223	-1	2.24	220.00	525.50	77.50	0
MASS723								
CONM2	724	224	-1	2.17	230.00	525.50	77.50	0
MASS724								
CONM2	725	225	-1	2.11	240.00	525.50	77.50	0
MASS725								
CONM2	726	226	-1	2.05	250.00	525.50	77.50	0
MASS726								
CONM2	727	227	-1	1.98	260.00	525.50	77.50	0
MASS727								
CONM2	728	228	-1	1.91	270.00	525.50	77.50	0
MASS728								
CONM2	729	229	-1	1.84	280.00	525.50	77.50	0
MASS729								
CONM2	730	230	-1	1.89	290.00	525.50	77.50	0
MASS730								
CONM2	731	231	-1	1.81	300.00	525.50	77.50	0
MASS731								
CONM2	732	232	-1	1.73	310.00	525.50	77.50	0
MASS732								
CONM2	733	233	-1	1.76	320.00	525.50	77.50	0
MASS733								
CONM2	734	234	-1	1.66	330.00	525.50	77.50	0
MASS734								
CONM2	735	235	-1	1.56	340.00	525.50	77.50	0
MASS735								
CONM2	736	236	-1	1.56	350.00	525.50	77.50	0
MASS736								
CONM2	737	237	-1	1.54	360.00	525.50	77.50	0
MASS737								
CONM2	738	238	-1	1.42	370.00	525.50	77.50	0
MASS738								
CONM2	739	239	-1	1.37	380.00	525.50	77.50	0
MASS739								
CONM2	740	240	-1	1.31	390.00	525.50	77.50	0
MASS740								
CONM2	741	241	-1	1.29	400.00	525.50	77.50	0
MASS741								
CONM2	742	242	-1	0.80	410.00	525.50	77.50	0
MASS742								
CONM2	743	243	-1	0.71	420.00	525.50	77.50	0
MASS743								
\$								
\$								
+MASS702	316.5	0	126.6	0	0	126.6		
+MASS703	459.3	0	330.6	0	0	330.6		
+MASS704	461.5	0	332.1	0	0	332.1		
+MASS705	323.0	0	232.5	0	0	232.5		
+MASS706	87.8	0	53.6	0	0	53.6		
+MASS707	92.2	0	56.2	0	0	56.2		
+MASS708	96.5	0	58.8	0	0	58.8		
+MASS709	100.8	0	61.5	0	0	61.5		
+MASS710	105.1	0	64.1	0	0	64.1		
+MASS711	109.5	0	66.8	0	0	66.8		
+MASS712	113.8	0	69.4	0	0	69.4		

+MASS713	118.1	0	72.0	0	0	72.0
+MASS714	122.5	0	74.7	0	0	74.7
+MASS715	126.8	0	77.3	0	0	77.3
+MASS716	124.8	0	76.1	0	0	76.1
+MASS717	122.7	0	74.9	0	0	74.9
+MASS718	158.8	0	114.3	0	0	114.3
+MASS719	118.7	0	72.4	0	0	72.4
+MASS720	128.9	0	84.6	0	0	84.6
+MASS721	119.5	0	79.4	0	0	79.4
+MASS722	110.5	0	74.4	0	0	74.4
+MASS723	101.8	0	69.6	0	0	69.6
+MASS724	93.6	0	64.9	0	0	64.9
+MASS725	85.8	0	60.5	0	0	60.5
+MASS726	78.3	0	56.2	0	0	56.2
+MASS727	71.3	0	52.1	0	0	52.1
+MASS728	64.5	0	48.2	0	0	48.2
+MASS729	58.2	0	44.4	0	0	44.4
+MASS730	56.0	0	43.8	0	0	43.8
+MASS731	50.0	0	40.1	0	0	40.1
+MASS732	44.3	0	36.6	0	0	36.6
+MASS733	41.8	0	35.5	0	0	35.5
+MASS734	36.5	0	32.1	0	0	32.1
+MASS735	31.6	0	28.8	0	0	28.8
+MASS736	29.0	0	27.5	0	0	27.5
+MASS737	26.2	0	26.0	0	0	26.0
+MASS738	21.9	0	22.8	0	0	22.8
+MASS739	19.3	0	21.1	0	0	21.1
+MASS740	16.6	0	19.2	0	0	19.2
+MASS741	14.7	0	18.1	0	0	18.1
+MASS742	8.1	0	10.7	0	0	10.7
+MASS743	6.4	0	9.1	0	0	9.1

\$ LUMPED MASSES FOR RIGHT SIDE HORIZONTAL TAIL

CONM2	802	302	-1	4.97	387.10	530.25	77.80	0
MASS802								
CONM2	803	303	-1	4.73	386.66	539.75	79.47	0
MASS803								
CONM2	804	304	-1	7.69	387.79	549.25	81.06	0
MASS804								
CONM2	805	305	-1	4.26	385.75	558.75	82.82	0
MASS805								
CONM2	806	306	-1	4.03	385.29	568.25	84.49	0
MASS806								
CONM2	807	307	-1	7.00	387.18	577.75	86.04	0
MASS807								
CONM2	808	308	-1	3.58	384.33	587.25	87.84	0
MASS808								
CONM2	809	309	-1	3.35	383.83	596.75	89.51	0
MASS809								
CONM2	810	310	-1	6.34	386.70	606.25	91.01	0
MASS810								
CONM2	811	311	-1	2.92	382.81	615.75	92.87	0
MASS811								
\$								
+MASS802	37.4	0	1504.7	0	0	1542.1		
+MASS803	35.6	0	1289.2	0	0	1324.7		
+MASS804	33.8	0	1149.5	0	0	1149.5		
+MASS805	32.0	0	923.6	0	0	955.6		

+MASS806	30.3	0	770.9	0	0	801.2		
+MASS807	28.6	0	710.0	0	0	710.0		
+MASS808	26.9	0	519.2	0	0	546.1		
+MASS809	25.2	0	417.6	0	0	442.8		
+MASS810	23.6	0	427.7	0	0	427.7		
+MASS811	22.0	0	256.7	0	0	278.7		
\$ LUMPED MASSES FOR RIGHT SIDE VERTICAL TAIL								
CONM2	902	402	-1	3.06	413.63	524.05	81.48	0
MASS902								
CONM2	903	403	-1	2.91	414.65	521.15	89.45	0
MASS903								
CONM2	904	404	-1	5.97	418.34	518.25	97.42	0
MASS904								
CONM2	905	405	-1	2.63	416.67	515.35	105.39	0
MASS905								
CONM2	906	406	-1	2.49	417.67	512.45	113.36	0
MASS906								
CONM2	907	407	-1	2.36	418.66	509.55	121.33	0
MASS907								
CONM2	908	408	-1	5.43	422.59	506.65	129.30	0
MASS908								
CONM2	909	409	-1	2.1	420.61	503.75	137.27	0
MASS909								
CONM2	910	410	-1	1.98	421.57	500.85	145.23	0
MASS910								
CONM2	911	411	-1	1.86	422.50	497.95	153.20	0
MASS911								
\$								
+MASS902	18.3	0	616.3	0	0	597.9		
+MASS903	17.5	0	547.1	0	0	529.7		
+MASS904	16.6	0	483.7	0	0	467.1		
+MASS905	15.8	0	425.8	0	0	410.0		
+MASS906	14.9	0	373.1	0	0	358.2		
+MASS907	14.1	0	325.3	0	0	311.2		
+MASS908	13.3	0	282.3	0	0	269.0		
+MASS909	12.6	0	243.7	0	0	231.1		
+MASS910	11.8	0	209.3	0	0	197.5		
+MASS911	11.1	0	178.9	0	0	167.8		
\$								
\$								
PBEAM	2301	1	100.	1000.	1000.	0.	1000.	
PBEAM	2401	1	100.	1000.	1000.	0.	1000.	
\$								
\$ RIGHT SIDE BEAMS FROM H-TAIL MAIN BEAM TO HINGE LINE								
CBEAM	2301	2301	301	2501	302			
CBEAM	2302	2301	302	2502	301			
CBEAM	2303	2301	303	2503	301			
CBEAM	2304	2301	304	2504	301			
CBEAM	2305	2301	305	2505	301			
CBEAM	2306	2301	306	2506	301			
CBEAM	2307	2301	307	2507	301			
CBEAM	2308	2301	308	2508	301			
CBEAM	2309	2301	309	2509	301			
CBEAM	2310	2301	310	2510	301			
CBEAM	2311	2301	311	2511	301			
\$								
\$ RIGHT SIDE BEAMS FROM H-TAIL HINGE LINE TO H-TAIL TRAILING EDGE								

CBEAM	2321	2301	2501	2301	2502
CBEAM	2322	2301	2502	2302	2501
CBEAM	2323	2301	2503	2303	2501
CBEAM	2324	2301	2504	2304	2501
CBEAM	2325	2301	2505	2305	2501
CBEAM	2326	2301	2506	2306	2501
CBEAM	2327	2301	2507	2307	2501
CBEAM	2328	2301	2508	2308	2501
CBEAM	2329	2301	2509	2309	2501
CBEAM	2330	2301	2510	2310	2501
CBEAM	2331	2301	2511	2311	2501

\$ RIGHT SIDE BEAMS FROM V-TAIL MAIN BEAM TO HINGE LINE

CBEAM	2401	2401	401	2601	402
CBEAM	2402	2401	402	2602	401
CBEAM	2403	2401	403	2603	401
CBEAM	2404	2401	404	2604	401
CBEAM	2405	2401	405	2605	401
CBEAM	2406	2401	406	2606	401
CBEAM	2407	2401	407	2607	401
CBEAM	2408	2401	408	2608	401
CBEAM	2409	2401	409	2609	401
CBEAM	2410	2401	410	2610	401
CBEAM	2411	2401	411	2611	401

\$

\$ RIGHT SIDE BEAMS FROM V-TAIL HINGE LINE TO V-TAIL TRAILING EDGE

CBEAM	2421	2401	2601	2401	2602
CBEAM	2422	2401	2602	2402	2601
CBEAM	2423	2401	2603	2403	2601
CBEAM	2424	2401	2604	2404	2601
CBEAM	2425	2401	2605	2405	2601
CBEAM	2426	2401	2606	2406	2601
CBEAM	2427	2401	2607	2407	2601
CBEAM	2428	2401	2608	2408	2601
CBEAM	2429	2401	2609	2409	2601
CBEAM	2430	2401	2610	2410	2601
CBEAM	2431	2401	2611	2411	2601

\$

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REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE March 2001		3. REPORT TYPE AND DATES COVERED Contractor Report
4. TITLE AND SUBTITLE Response of the Alliance 1 Proof-of-Concept Airplane Under Gust Loads			5. FUNDING NUMBERS C NAS1-96014 710-10-11	
6. AUTHOR(S) A. S. Naser, A. S. Pototzky, and C. V. Spain				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Lockheed Martin Engineering and Sciences Company Langley Program Office Mail Stop 371, Langley Research Center Hampton, VA 23681-2199			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) National Aeronautics and Space Administration Langley Research Center Hampton, VA 23681-2199			10. SPONSORING/MONITORING AGENCY REPORT NUMBER NASA/CR-2001-210649	
11. SUPPLEMENTARY NOTES Langley Technical Monitor: Dawn C. Jegley				
12a. DISTRIBUTION/AVAILABILITY STATEMENT Unclassified-Unlimited Subject Category 39 Distribution: Nonstandard Availability: NASA CASI (301) 621-0390			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) This report presents the work performed by Lockheed Martin's Langley Program Office in support of NASA's Environmental Research Aircraft and Sensor Technology (ERAST) program. The primary purpose of this work was to develop and demonstrate a gust analysis method which accounts for the span-wise variation of gust velocity. This is important because these unmanned aircraft having high aspect ratios and low wing loading are very flexible, and fly at low speeds. The main focus of the work was therefore to perform a two-dimensional Power Spectrum Density (PSD) analysis of the Alliance 1 Proof-of-Concept Unmanned Aircraft. As of this writing, none of the aircraft described in this report have been constructed. They are concepts represented by analytical models. The process first involved the development of suitable structural and aeroelastic Finite Element Models (FEM). This was followed by development of a one-dimensional PSD gust analysis, and then the two-dimensional (PSD) analysis of the Alliance 1. For further validation and comparison, two additional analyses were performed. A two-dimensional PSD gust analysis was performed on a simplet MSC/NASTRAN example problem. Finally a one-dimensional discrete gust analysis was performed on Alliance 1. This report describes this process, shows the relevant comparisons between analytical methods, and discusses the physical meanings of the results.				
14. SUBJECT TERMS Gust, VonKarman, Aeroelasticity, Frequency Response, Flutter, Trim, Finite Element, Flexible Wing			15. NUMBER OF PAGES 255	
			16. PRICE CODE A12	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL	